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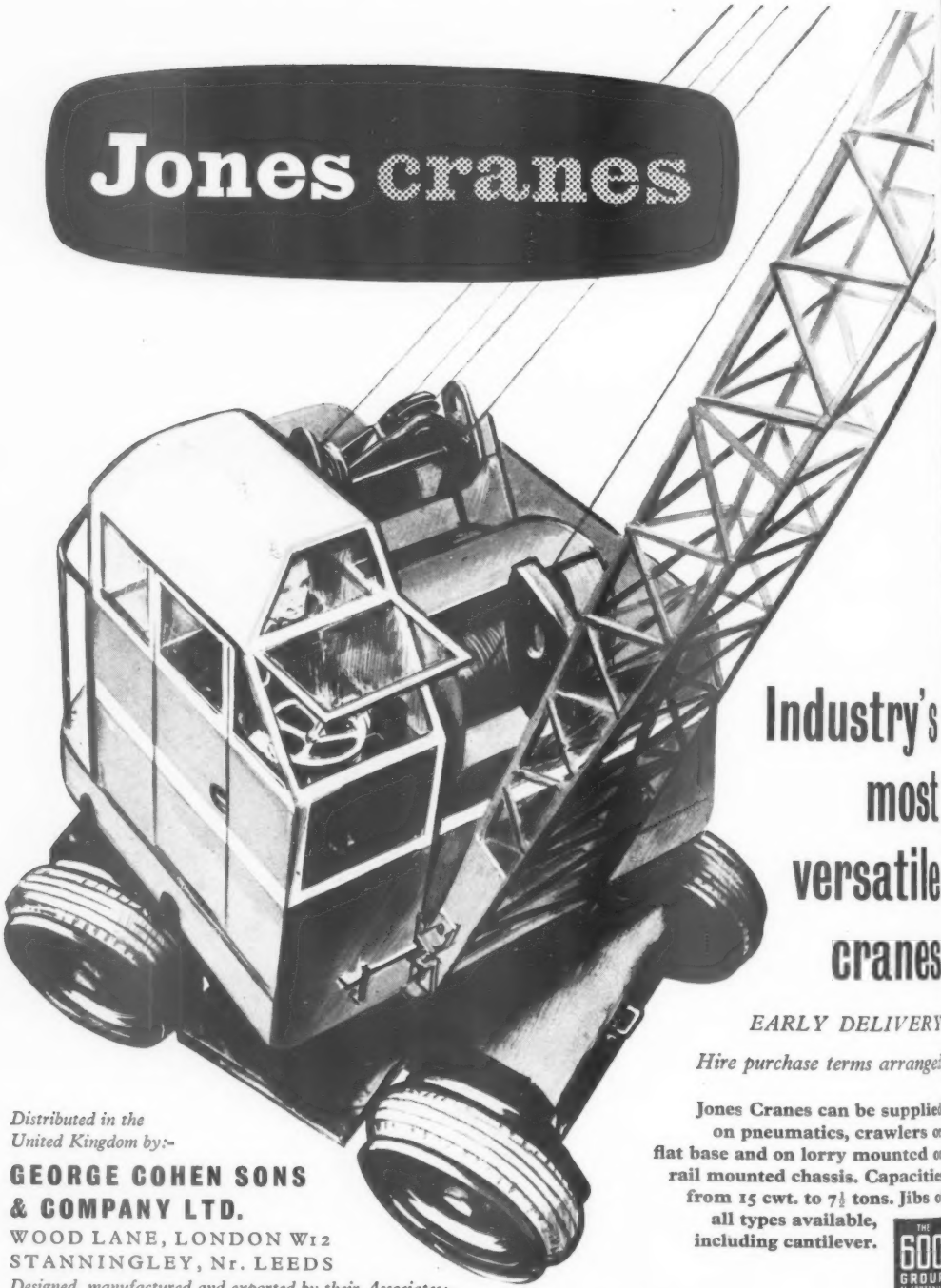

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# National Apprentice Competition?

In the past, we have never been too enthusiastic about practical competitions for apprentices—especially on a national scale—as a malady designated "swelled head" is likely to be found in the winner. That matter, however, is of but minor importance. The outcome of the recent competition organized by the London branch, and no doubt also that of the Tees-side branch, of the Institute of British Foundrymen is exceptionally encouraging. When a competition for apprentice moulders to make a given casting is envisaged, it would seem—from the cost angle—that the provision of patterns could be arranged quite cheaply by the prior organization of a competition for apprentice patternmakers. Nevertheless, this cannot, in all fairness, be undertaken, as the nature of the casting to be made would become known at too early a stage to the young moulders. Thus such competitions can be expensive, for there is not only the making of the pattern and core-boxes, but also transport, the preparation of rules, much correspondence and telephoning. Finally there is assembly of the entries at a central depôt and their judging, the purchase and engraving of prizes, diplomas and the arrangements for their presentation. Truly it is a formidable task.

The examiners, who, for the London competition, were drawn from West of England, Birmingham and the North East Coast, were loud in their praises of the quality achieved, and amazed at the large numbers of solutions presented in the moulding and running of the competition casting. Their task was not easy in selecting the best from such a large number of entries. We have not published descriptions of the patterns, or pictures of the winners' efforts, as the patterns are being kept in case some other branch of the Institute decides to utilize them.

The effect of this competition in the London area has indeed been an outstanding success. On all sides, we hear of an added interest being taken in their work by the apprentices. Furthermore, this interest has spread right up from the foundry floor to the Boardroom. We are told that the competition has already had a beneficial influence on recruitment. Moreover, this upsurge has not only been noted in the plants where the winners were engaged, but from wherever competitors were drawn. It has been excellent publicity for the Institute and has every appearance of providing just that stimulus for which the industry has been waiting for a long time. We have stressed both the cost and work involved, but the results achieved have unquestionably thoroughly justified all that has been done. Finally, there is every indication that the time is ripe for a competition to be organized on a national basis or perhaps, as it is difficult to compare ferrous with non-ferrous, the bodies responsible for the various sections of the industry should organize their own.

## Congress Fund

In addition to the subscriptions to the Congress Fund of the Institute of British Foundrymen published in the January 27 and March 31 issues of the JOURNAL, the donations listed below have been received. Mr. N. P. Newman, J.P., of Newman, Hender & Company, Limited, Woodchester, Stroud, Glos, the honorary treasurer, will be very pleased to receive additional subscriptions.

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### VENTILATING A SMALL FOUNDRY

*To the Editor of the* FOUNDRY TRADE JOURNAL

SIR,—In the leading article of your issue for May 12, dealing with the recent Harrogate Conference organized by the British Cast Iron Research Association on Foundry Ventilation and Dust Control, it is stated that two members of the staff of the Building Research Station advocated low roofs for foundries, since they were easy to ventilate. This statement does not convey a correct impression of the work and opinions of the men concerned.

In point of fact, the paper referred to was the result of joint work between the Building Research Station and the British Cast Iron Research Association, and was concerned in particular with the smaller jobbing foundry, in which negligible mechanical extraction of dust by local exhaust ventilation was maintained. It was pointed out that when natural ventilation was being considered, the larger head from a high building would provide a ventilation system inherently more stable, and not so likely to be reversed by wind. The statement that the roof could be low was another way of suggesting that the extract system should be near to the source of dust.

The important conclusion was that where natural ventilation only is employed, high buildings are required to maintain a stable head, but with mechanical ventilation, the roof, or, alternatively, the effective point of extract, may be lower and subject only to crane requirements.

The use of unnecessarily-high buildings increases the cost of construction, and the cost of ventilation and heating. It is therefore in the interests of the foundryman to keep his building heights as low as possible, consistent with production requirements. It may be remembered that the "Garrett Report," in its recommendations on the planning of new foundries, made the point that certain ventilating schemes depend for their success on a comparatively low roof; it was for this reason that the Garrett committee concluded that it was not possible to specify a minimum height for new shops.

As far as we are aware, this paper is the first to be published which bases its results entirely on the study of air movement in working foundries. It cannot, therefore, be regarded as of theoretical interest only. Further work is likely to be carried out, which should enable more positive recommendations to be made.

We think it is important, in fairness to the Authors, that these points should be brought forward.—Yours, etc.,

H. T. ANGUS,
Development Manager.
British Cast Iron Research Association,
Alvechurch,
Birmingham.
May 20, 1955.

# Cores and Moulds by the $CO_2$ Process*

*By A. Talbot*

*From being a foundry typical of thousands of others producing castings by conventional practices of dry- and green-sand moulding and oil-sand coremaking, the Author describes the changes brought about in his shops by the introduction of the $CO_2$ Process—first to cores, then to moulds. Numerous examples are quoted and comparative costs are touched upon, though the emphasis is on saving of core-stove and drying-oven space.*

Seven months ago the Author's foundry was typical of thousands in this country, carrying on green and dry-sand moulding, general jobbing work, in iron and non-ferrous alloys. There were what were regarded as orthodox practices in moulding and coremaking, with a distinct tendency to adopt the oil-sand block core method of mould production. Cores were of 100 per cent. oil-sand and the larger type of dry-sand moulded castings were being produced more frequently with an oil-sand facing than with natural sand. To comply with this practice the firm, early in 1954, had equipped themselves with a completely new recirculating drying stove for heavy work. Thermostatically and automatically controlled, it had a capacity as large as was possible and indeed proved equal to the expected demands, as envisaged at this period. There was also a similar type of stove for the small-core production.

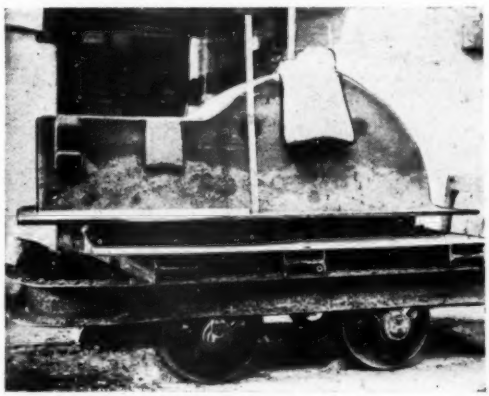
The standard of casting being made was satisfying the customers—(as far as one can ever get customers satisfied !), and the founders were satisfied that they were doing their utmost to meet demands. The parent company had introduced improved designs of products with which it was intended to engage more fully in a highly competitive overseas market. These new designs called for an accuracy never before obtained in the castings which the foundry supplied, for instance certain machining operations were eliminated. New features were introduced which on paper seemed very ordinary, but which to foundrymen were a nightmare. All previous methods of coremaking for the particular job " went by the board," and something new had to be undertaken. It should be added here that from the very outset the technical director had kept the foundry department fully informed as to his requirements, and also it was made clear that should the foundry fail to deliver the type of castings required, resort could always be made to the old, more-costly, method of machining. Naturally, this put the founders " on their metal."

Coupled with this new requirement, the trend of work tended more and more toward cored and dry-sand moulding, and the founders were becoming faced with lagging production at a time when it could least be allowed. Stove capacity became totally inadequate, due to large cores and moulds all needing to be dried in the same oven, temperature control had to be introduced to a degree which made mould-drying time longer, hence an unbalanced production resulted, which was daily becoming more embarrassing. The type of work available at this period did not in the Author's opinion warrant the risk of green-sand moulding, though it should be added here that he and his associates are not considered inexpert in green-sand moulding, as many members of the Institute can verify.

### The New Process

The prospect of a large capital outlay for further stoving capacity seemed inevitable, and the subsequent delay until such an installation was completed appeared to be unavoidable. Consequently, August, 1954, was as disturbing in the " foundry outlook " as were the weather forecasts of that period, and the offer of an introduction to the comparatively new technique of $CO_2$ Process came and was welcomed, as are any new ideas in the Author's foundry. An immediate impression was made ! Possibilities seemed to mature after a most crude demonstration had taken place, additional informa-

FIG. 1.—*The first production core made by the $CO_2$ Process at the Author's foundry. It is 4 ft. 6 in. long by 1 ft. 10 in. high by 1 ft. 4 in. wide, for a gearbox cover and weighing 12½ cwt. (one of the parent company's requirements).*



* Paper presented to the London branch of the Institute of British Foundrymen, Mr. W. Wilson presiding. The Author is attached to Western Foundries, Southall, Middlesex.

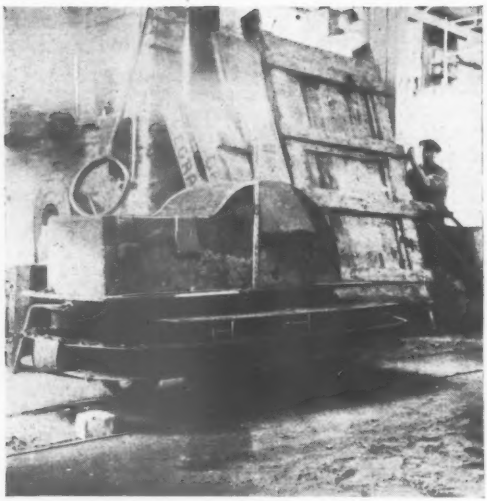


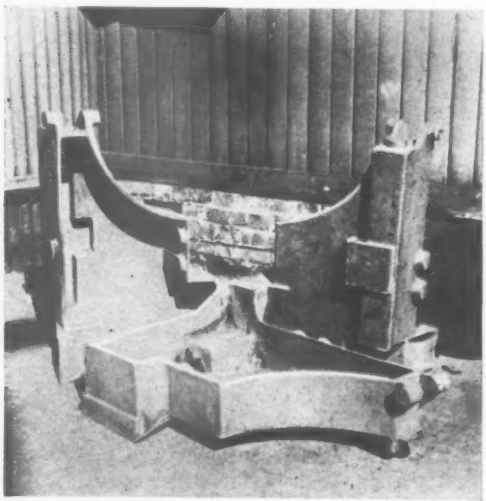
FIG. 2.—*The same job as shown in Fig.* 1 *but two weeks later. This was the sixth successful effort in production. In the background is a large corebox, typical of those which rendered the firm's coredrying facilities inadequate.*

FIG. 4.—*Pattern equipment for the casting shown in Fig.* 3. *This incidently was customers' property, so that, although the foundry had decided on the construction, the tackle was purely conventional.*

tion was requested, and was supplied. Furthermore, the experience of Mr. Johnson, of a supplying firm, who had carried out a lot of pioneer work on the $CO_2$ Process in steelfounding and other fields was made available.

In three days, the first crude demonstration progressed to the stage of controlled experiment, and a week later from experiment to trial. The trial made clear a possible solution to the foundry's major worry of stove capacity and from this stage necessity became the mother of invention of the method of application of the new process, with every member of the staff of the foundry working on the new project, yet having a completely open mind and backed by all the best technical knowledge available.

FIG. 3.—*Another successful trial casting,* 3 *ft.* 3 *in. by* 2 *ft. with a depth varying up to* 12 *in. and of total weight* 3½ *cwt.*



Production by the $CO_2$ Process became an accomplished fact in the Author's foundry in one month, and the two senior coremakers on the staff had become even more versatile than ever before; to the extent to which one core would be made by the established oil-sand method, and the next by the new $CO_2$ Process. The difference, by comparison, was so remarkable as to appear almost unbelievable. To the Author, this Process could surely represent a new epoch.

### Early Success

Figs. 1 to 7 illustrate the rapidity of the initial progress and development at Western Foundries. These illustrations were first shown at a meeting of the Southampton section of the Institute in September, 1954, when the Author presented a short paper and demonstration of the $CO_2$ Process—after one month's experience. At that time it is believed these were the largest examples that had been successfully accomplished in ironfounding. It will be appreciated that all of the jobs illustrated would have required grids if made by the normal practice

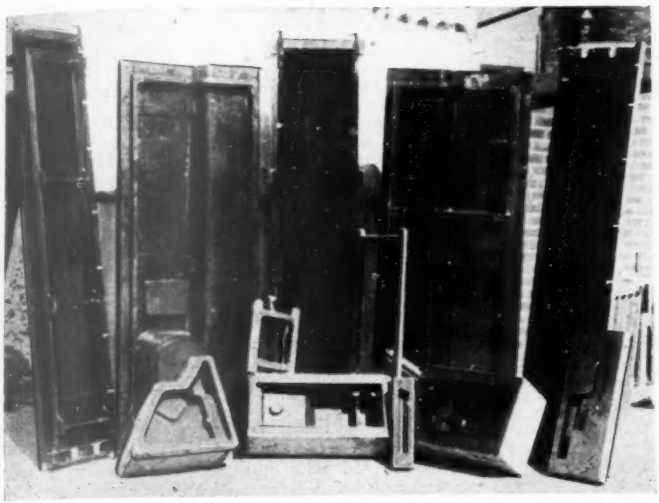


FIG. 5.—*A more ambitious job, 7 ft. long by 2 ft. 6 in. wide by 1 ft. 2 in. deep, with sections varying up to 1-in. thick from ½-in. wall section. Nine coreboxes in all were required, two large, three medium (two of these had to be hung in the top) and four small.*

of the foundry, but the use of $CO_2$ had eliminated this costly item in core production.

To-day the foundry's production "bottleneck" as previously described does not exist. Stove temperature has been raised to give adequate drying, thus giving mould production schedules as required. *All* cores are now produced by the $CO_2$ Process in this foundry. Storage space for moulds awaiting cores or cores awaiting moulds is no longer necessary.

Other advantages are that coremaking need not commence until the mould is approaching readiness to receive the cores; handling is greatly reduced, and efficiency is automatically developed (synchronizing of planned production becomes an accomplished fact, due to direct control of one of the variables).

The *demands,* mentioned previously, of the firm's technical department became just additional requests, met without any extra cost on the product; therefore economy was linked with improved production which meant a contribution was made from the foundry to the company's competence in world trade. A further set of illustrations taken at this period of pattern tackle and castings which demonstrate the progress made are Figs. 8 to 15, details of which are contained in the captions. This series of illustrations depicts progress up to December, 1954; many obstacles had been overcome, four and a half months of practice had proved beyond any shadow of doubt that the $CO_2$ Process would be a valuable asset to production in the firm's iron and non-ferrous foundry. This statement, it is felt, will be substantiated in many of the foundries of the Author's acquaintance.

Although no illustrations are available to show the large aluminium castings utilizing this process which were produced in this development period, castings were actually made weighing up to 7½ cwt., heavily cored, in different aluminium alloys, and with sections varying from ⅛ in. upwards.

**Present Scope**

So much for the reason for introduction and development of $CO_2$ Process in the Author's establishment. Next will be quoted the practice as operated at present. At the outset it should be pointed out that this pattern of production which will now be elaborated, is based completely on practical experience peculiar to the foundry under discussion. Up to the present time the Author has not had a single opportunity of exchanging information or views

FIG. 6.—*Internal view of the casting made from the tackle shown in Fig. 5. It weighs 12 cwt. and the cleanliness is noteworthy. (An external view of this same casting was recently included in a Paper by Dr. Atterton.)* (JOURNAL, *May 5 and 12, 1955.*)

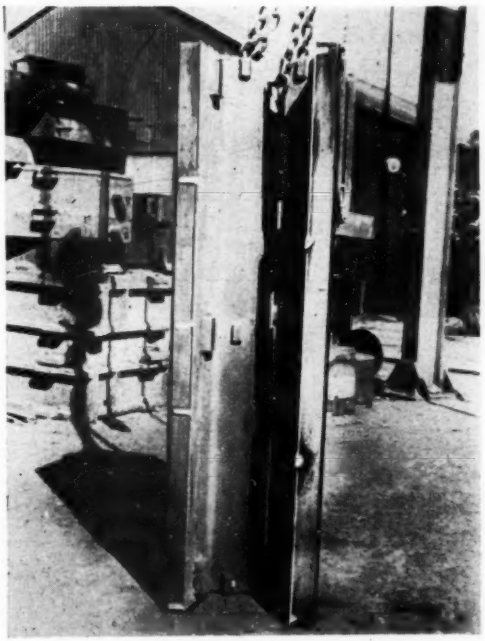
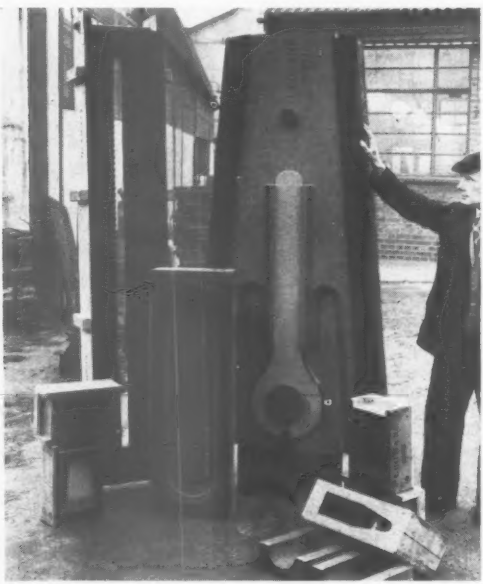


FIG. 7.—*Another casting needing heavy coring. Previously, production of the main core for this casting required a total of seven crane lifts.*

FIG. 8.—*Pattern equipment for Western Foundries' new-type product. It is* 7 *ft. long by* 2 *ft.* 3 *in. (at the widest point) by* 10 *in. deep.*



with any of the many people who have visited his foundry, and who have since started $CO_2$-Process production in their own works. Therefore the procedure to be described is based on six months' domestic experience.

### Sand Preparation

The sand mix adopted is as follows:—100 lb. of a dry Erith silica sand (not always cold); with 4 per cent. (maximum) of a proprietary type of binder containing silicate of soda as its base; 1 per cent. (maximum) of pelleted pitch for iron or non-ferrous castings (excepting aluminium alloys; and 1 per cent. wood-flour substituted for the pitch in the case of aluminium alloys. The pelleted pitch or wood-flour has to be well mixed with the sand before adding the binder, and mixing of all the commodities needs to be carried to completion in a correct type of mixer. In the Author's considered opinion this is a prime factor affecting successful, mediocre or poor final results.

The mixed sand is discharged into containers and protected as far as possible from the atmosphere if not for immediate use. For this, ordinary dustbins are used and lids make adequate covers for ordinary storage. A sack pressed over the sand, with lid applied, keeps any unused material in good condition overnight. In fact, no sand is lost except by sheer neglect. Frequently, a special trial mix can be held over for several days by simply damping (*not swamping*) the covering sack with water. No variation in mix is made for heavy or light work in iron, gunmetal or brass, coremaking or moulding.

### Core Production

Due to the texture of the resulting sand mix, the ramming of coreboxes is carried out by blunter rammers than those used for ordinary oil-sand. Sand is pushed on to a face rather than rammed. No core irons are required for small cores and larger cores do not require grids; the very minimum of reinforcement is provided only when considered essential. Ashes, clinker and foundry refuse, including broken core material is used, not for venting purposes, but for reducing the bulk required of prepared sand. Cores can be hollowed out where easily practicable, purely for economy. No danger of hollow cores distorting or sagging exists, due to all hardening being carried out before the core leaves the box. Venting is not so important, and is seldom resorted to.

Standard, orthodox and existing coreboxes are used. New equipment is manufactured to very much closer dimensional limits and with greater attention to such detail as, prior to the changeover, would otherwise have had to be neglected. Damage to coreboxes by rapping is obviated and subsequent inaccuracy of coreboxes due to such rapping is thereby completely eliminated. Thus, the cores produced are exact reflections of the patternmaker's skill and ability. To be jocular at the expense of patternmakers—foundry distortion of patternshop infalli-

FIG. 9.—*Mould and core assembly for the job shown in Fig. 8. (Note the gating system adopted and the danger of burning-in.)*

bility is finished forever. Seriously, however, this at least is progress which is not just confined to the highly-equipped shop, but is possible to each and every job from one off to production in large quantities, wherever made.

Patternmakers of the Author's acquaintance have agreed that at last it is possible to make a true core from any true wooden box. A word of caution is necessary here—a rough box still means a rough core, and an undercut is still an undercut even in the $CO_2$ Process, so let patternmakers take heed! Nevertheless, good patternmakers need not worry, providing they are as accurate as they would have founders to believe.

### Method of Gas Application

Gas application is carried out to a strict but automatic cycle. The Author's practice is based on a 20-sec. at 20-lb. rule—the explanation being briefly that $CO_2$ gas applied at 20-lb. per sq. in. for 20 sec. will react sufficiently on an approximate area of 100 sq. in. of sand, and to a depth (according to ease of access) up to 10 in. max. Therefore, under ideal conditions, a 10-in. cube of material can be treated sufficiently well in 20 sec. at 20-lb. per sq. in.

This gassing routine is the result of carefully controlled tests. At the outset only very sketchy ideas were held, and it was at once apparent that some form of practice or technique had to be evolved. The gas had to be controlled to reduce waste, also so as to prevent overgassing in localized areas—simplicity had to be the main factor. Tests were carried out on a standard core 6-in. o.d. by 20-in. long, with a 2-in. dia. central cavity. At the very outset, " 20 for 20 " was found to be a good criterion. Higher pressures for shorter times, or lower pressures for longer times all fell below the results obtained at " 20 for 20." It was then felt there was firm basis on which to work. Different mixes were tried with varying pressures and times, but one very significant factor became apparent, and that was whatever the ratio " 20 for 20 " gave the best gassing results and was therefore established as standard practice, and up to the present time there has been no reason to alter what is now routine in the shop.

### Methods of Introducing Gas

Methods of introducing the $CO_2$ gas are many and varied. The Author's standard method is to use a thick rubber pad with criss-cross channels cut into the face coming into contact with the sand. These channels all lead to a central point which is connected to a gas inlet device inserted into a drilled hole—. The pads vary in size, but are all one-inch thick—a dimension determined by the material available at the time. Experiments on thinner rubber sheet and other flexible materials have not proved equal in success to those using sheet rubber one-inch thick.

One rule always preached, and which it is endeavoured to practise is: Never over-gas, rather err to the reverse and under-gas! The reason is obvious to a user, and it is briefly this; any core which has not had enough gas to complete the chemical reaction of the binder, can always absorb further $CO_2$ from the atmosphere, or further application of

FIG. 10.—*Finished castings (see Figs. 8 and 9); they weigh 27¾ cwt. each. (Note the faces as yet unmachined, and cleanliness of the rack teeth and tee slot.)*

FIG. 11.—*Typical cores produced by the $CO_2$ Process for various castings. (Note the use of wooden boards; there is no danger of core sag or distortion.)*

gas can be carried out after removal from the core-box. A core which has been over-gassed tends to become friable on the surface, and generally have a bad finish. This cannot be rectified, therefore extravagant use of gas is both costly and damaging to final results. The three main features kept well in mind are flexibility, simplicity and adaptability.

**Equipment**

Equipment necessary for $CO_2$-Process core and mould production is, in the Author's opinion, the "foundryman's dream." Costs are negligible for initiation to the process, and experimental work can be carried out without any capital outlay; development costs are minute; the $CO_2$ gas is readily obtainable and plentiful. The latter is supplied in suitable containers and only the gas is chargeable. The gas has to be conveyed from the storage vessel to the corebox via a tube. The Author's first outfit for this work cost him the not exorbitant total of 2s. 8d. (which included the 12-in. copper pipe to make a nozzle (1s. 2d.) and 6 ft. of rubber tubing at 3d. per ft.). This sort of equipment is quite suitable for initial experiments.

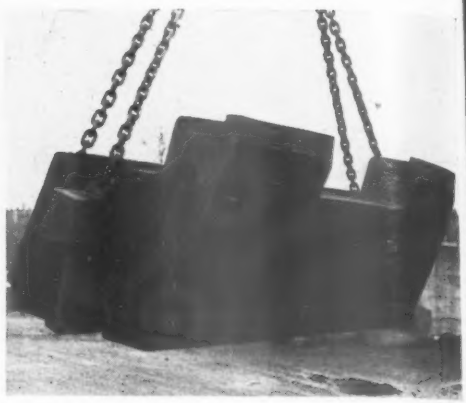


FIG. 13.—*Rear recess view of 2½-ton body casting shown in Fig. 12.*

The next stage of the evolution of equipment took the form of the purchase of suitable reduction valves. It must be borne in mind that $CO_2$ gas when supplied is at very high pressure—in the region of 300 to 600 lb. per sq. in. and the only way to supply controlled low-pressure gas to the place of its functional activity is via reduction valves. If it next be assumed the foundryman is equipped with a suitable valve, and development has progressed to operational level, it is at this point that the first "hurdle" appears, and that is "freezing up." The very action of passing a large volume of gas from a high-pressure container to the low-pressure system causes the freezing up of the reduction valves. Experience proved that one could operate for about 20 minutes before stoppage was brought about due to this cause.

**Problem Solved**

The remedy for freezing-up at first seemed to lie in the provision of a number of reduction valves to enable a fresh valve to be in operation, whilst the previous one was being thawed out. To practical men, however, this was purely improvizing and another device which was offered by the supply firm and which it was hoped would surmount this obstacle was purchased. The

FIG. 12.—*Vibrator body (2½ tons), heavily cored, in which sharp edges are very essential, these presenting no difficulty when made by the $CO_2$ Process.*

FIG. 14.—*Collection of cores in production at one period during the development work at Western Foundries.*

cost of this effort seemed at first to be warranted by the initial success in obviating freezing. However, as conversion to $CO_2$-Process production was becoming accelerated, trouble was again experienced with the reduction valves, making even the new unit unsatisfactory to cope with requirements at this stage. This was a great setback : The engineers in the $CO_2$-gas industry knew nothing about foundrywork, foundry conditions or requirements and those in the foundry knew nothing about $CO_2$ gas. One had nothing in common with the other, so that faults which to the foundrymen seemed so obvious, appeared to be incomprehensible to the $CO_2$-gas collaborators.

In the meantime, the founders were forced to "mark time" and this was a critical period in the Author's experience—the question being whether to press forward or forget the whole idea. However, the technical staffs of the $CO_2$ supplying firms were extremely busy and many exchanges of information took place; finally after a short delay a positive solution was found (see Fig. 16).

It is now pleasing to report that a continuous supply of low-pressure $CO_2$ gas is no problem whatever and development of even better equipment is still in progress.

### Present Gas System

Thereupon, full conversion to the $CO_2$ Process for coremaking was decided upon, and the equipment now in use was produced by the firm's own staff, in the light of experience and knowledge of practical requirements (Fig. 17). The system is very simple—low-pressure gas is fed into a container at 30-lb. per sq. in.; a complete 2 in. mains circuit goes from the container right around the shop and back into the tank. The container, tank, or reservoir as it may be designated, was originally a compressor receiver of 20-cub. ft. capacity. Off-takes of ½-in. dia. pipe are taken off the main at all suitable points and a stopcock reduces the supply to the final ¼-in. pressure hose with the control cock and nozzle, from which to deliver gas at 20-lb. per sq. in. maximum.

### Cost

Next will be considered the most important item : Cost. This next section may be very controversial, but the figures offered are factual. Sand equals sand, whatever method of using it be adopted, so therefore, sand costs are not considered in what follows, for the sand one uses for orthodox moulding and coremaking practice is, presumably, the same as for $CO_2$ Process. An idea of comparison can then be :

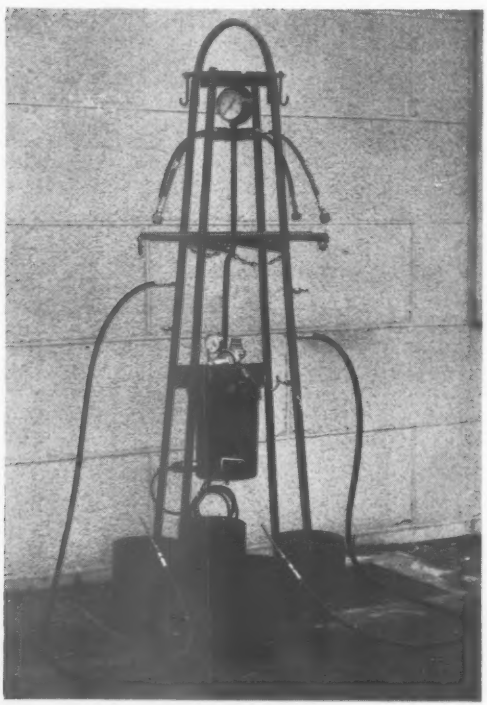
| $CO_2$ Process. | Per ton. | £ | Oil-sand. | Per ton. | £ |
|---|---|---|---|---|---|
| 100 tons sand .. at £x | | — | 100 tons sand .. at £x | | — |
| 4 per cent binder .. at £45 | = | 180 | 3 per cent. binder .. at £68 | = | 204 |
| 1 per cent. pelleted pitch .. .. at £20 | = | 20 | | | |
| | | 200 | | | 204 |
| Gas at 10s. per 28 lb. (28 lb. = 2 tons treated . . 100 = 50 × 10s.) .. .. | | 25 | Cost of stoving, labour, fuel, etc. .. .. | = | ? |
| | | | Cost of handling .. | = | ? |
| | | | Cost of grids, etc. .. | = | ? |
| | | | Cost of maintenance of plant | = | ? |
| Total for 100 tons of cores ready for use .. .. | | 225 | | | ? |

To the small founder, by reason of the very fact of lack of capital investment available, the $CO_2$ Process could be a boon, and also provide an opening to a wider sphere of activity. The larger establishment must needs compare production costs. One incident in the Author's own experience was in relation to the production of the large core, shown in Fig. 7, which previously required seven crane-lifts as follow : (1) Grid lifted into the corebox ; (2) core-plate on to the rammed core ; (3) turn over ; (4) on to the stove carriage ; (5) off ; (6) turn core back to original position ; and (7) lift and place the core into mould. When made by the $CO_2$ Process, this core required no grids and no core-plates. It was rammed up and then gassed ; one lift of the crane picked it out of the corebox, and it was then placed directly into the mould. Could one estimate the cost of six crane lifts; the time saved in waiting for crane; or the greater freedom for crane work conferred; then the true economy conferred by $CO_2$ working would be revealed.

### Knockout or Breakdown

The Author can state categorically that he has not had trouble at any stage with knocking-out. The castings vary from ounces to tons, in sections from ⅛ in. in aluminium to 18 in. in cast iron, yet there has always been a good finish, with perfect

FIG. 15 (*above*).—*Large core for a high-lead bronze bush. It is* 2 *ft.* 10 *in. dia. by* 3 *ft. long and made in halves from a strickled frame* (*Fig.* 15 (*a*)). *No reinforcing irons or grids are used, only loops for lifting purposes, these also being employed to join the core halves together.*



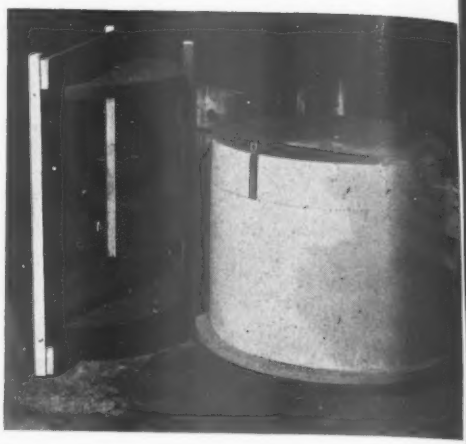


FIG. 15 (*a*).—*Pattern tackle for the bronze bush casting.*

sand break-away, with the previous oil-sand practise, and this ideal condition is still being maintained when using the $CO_2$ Process.

Cases have been heard of trouble with knock-out but these have never been experienced except in cases of personal neglect, which in any event spells trouble whatever method is used. It is felt, however, that work by the Institute's authorities is needed here. A practical viewpoint and conclusion is that: "If the mix is thorough, the result is there."

### Mould Making

This paper is devoted primarily to coremaking, but it must be added that in the last two months the firm has gradually diverted attention to $CO_2$ moulding. Indeed, had it not been for having to concentrate on the installation and operation of new melting equipment in the non-ferrous section, further progress in $CO_2$-Process mould would have been registered. At the very inception of the $CO_2$ adoption, it became apparent that the utilization of the process for some of "those awkward jobs" could offer enormous help. Thereupon, nasty "cods" were made by the $CO_2$ method and difficult top-part lifts more or less became cores. Jig work which seemed to be prone at the Author's works to these drawbacks, due to the cost of core-boxes, seemed to diminish in formidability. Losses were drastically cut—which in the case of "one-off" jobs meant everything.

This type of moulding work showed immediately beneficial results from transfer to $CO_2$ Process.

FIG. 16 (*left*).—*Apparatus developed by the Carbon Dioxide Company for delivery of* $CO_2$ *from "bottles" through a heated pressure-reducing reservoir.*

FIG. 17.—*Reservoir and distribution system in use at Western Foundries for supplying $CO_2$ to the coremaking bench.*

Operators on the floor who had shown at first curiosity, then interest, became almost enthusiastic to the extent that the $CO_2$ Process was practised in many unorthodox fashions. Here, it should be made clear that the $CO_2$ Process was not at any time pushed into the shop, it simply grew in popularity after the first experiments. A personal reaction to it was: "It isn't possible, yet one must try it to prove the impossibility." All the staff reacted as did the Author—here was something new, something novel, something which could possibly be of advantage, a means of reducing risks of extra work, and it will be agreed that this sort of "carrot" will interest even the least progressive.

That then was the psychological approach to the introduction of this revolutionary process of using $CO_2$ hardening—in other words: "Don't push them, entice them." First, a few jobs were suggested to the operators as suitable for adaptation to this new method after a full-scale trial for one of the regular items had proved completely successful at the first attempt. Needless to say, the experimental effort (Fig. 18) was watched by the whole shop, yet in a very discreet way.

Attention was also focused on this trial by the fact that it was being filmed, and it has to be reported that the only "scrapper" was the film, due to a camera defect. No casting ever produced by the foundry had such a close inspection by so many experienced critics, yet it was unanimously passed as O.K. The firm's latest development in this field is the production of the mould for the 2½-ton job which is the subject of the new film*, and the Author is firmly convinced that the same results will be achieved in moulding as are now practised in coremaking, and that in the very near future.

FIG. 18.—*Gassing a floor-moulded job—a "still" taken from the film produced at the Author's foundry.*

### General Observations and Conclusions

Coreboxes and patterns which have been used on oil-sand must be thoroughly cleaned of all adhesions for the best results to be obtained when used with the $CO_2$ Process. Paint and varnish are of no assistance to stripping, in fact, inferior materials can be troublesome, and the surfaces may need rubbing over with a plumbago rag to ensure a

* The Author later showed this film at the meeting.

*Cores and Moulds by the $CO_2$ Process*

clean, smooth strip. White wood strips perfectly, or perhaps one coat of ordinary varnish, which acts as a preservative to the timber, can be applied and then the box is normally trouble free. The abolition of paint and varnish is not advocated—after all, it looks good, and founders have a natural reluctance to see only the plain white wood. Perhaps, also, to be jocular, patternmakers sometimes, like founders ourselves, are thankful for a little camouflage. However, given well-made pattern equipment, accurate castings are assured from the $CO_2$ Process. To founders this is a very desirable goal, and the opportunity of reaching the ever-increasing dimensional accuracy demanded by modern standards, seems to be becoming an economical possibility by adopting the $CO_2$ Process. That process and shell moulding can be complementary and contributory to each other, but financially poles apart. The challenge represented by the $CO_2$ Process when more development has taken place may, therefore, prove the spur to even greater competence in the foundry industry.

## Metallurgical Failures in Diesel Engines

An investigation of the factors contributing to the failure of diesel-engine pistons and cylinder covers has been made by Dr. D. Fitzgeorge and Dr. J. A. Pope. An interim report was given by them recently at a meeting of the North-East Coast Institution of Engineers and Shipbuilders. In their researches, which were carried out on behalf of the British Shipbuilding Research Association, the stresses that occur in combustion-chamber parts have been investigated with regard to nature, magnitude, and likely contribution to failure.

It is deduced that cracks which commence at the hot side of the walls are due to residual stresses on cooling down, following plastic flow while running. This form of crack is shown to be most likely to occur in cast iron where ductility is low, and the authors have not so far encountered it in steel components. The danger spots are in the hot face of the cover, particularly where high thermal compressive stresses occur initially as a result of asymmetry, and in the hot face of the piston crown.

The second principal cause of failure is the fatiguing action of the repeated combustion pressures, combined with the tensile stresses occurring as a result of temperature gradients in the walls. The cracks occur at the horizontal junction of the crown and wall of pistons, and where webs and other scantlings meet the cover plate in cylinder covers. Failures of this type commence at the cooled side of the walls and occur in steel as well as cast-iron components. The effects of growth, additional stresses accompanying load changes, and the fluctuating surface stresses caused by the varying gas temperature are small, but the authors prefer to regard them as contributing factors causing somewhat earlier failures. Discussing typical failures, the authors select for detailed study radial cracks in cylinder covers and circumferential cracks in pistons. Direct estimates of the initial thermal compressive stresses in an unsymmetrical cover range from 16 to 28 tons/sq. in. Being higher than previous estimates, these values support the residual-stress theory of failure. A theoretical investigation of the stresses in an idealized piston shows that cracking at the junction of the crown and skirt is caused by fatigue. Examination of four actual failed pistons confirms this.

Calculated stress curves show the variation of piston stresses with changing wall and crown thickness. The stresses due to combustion pressure are found to be independent of the size of the piston, but dependent on its proportions. This applies to the thermal stresses also, provided that the temperature distribution is the same. Since the piston temperatures increase with increasing size, the thermal stresses in large pistons are greater than in small ones. The stresses produced by the combustion load are shown to be smallest when the crown and wall are thick. For low thermal stresses, a thin crown is necessary; for low thermal stresses in the wall, the wall should be thick, but a thick wall causes high thermal stresses in the crown. An example has been worked out to show graphically the variation in the overall stress conditions at the inner edge of the wall and at the inside face of the crown centre as the crown and wall thicknesses are varied. For the conditions assumed, the wall and crown should be approximately of equal thickness and one-tenth of the piston diameter. These figures include consideration of the compressive stresses in the hot face of the crown. The conclusion is drawn that where circumferential cracking has occurred in the wall, in the absence of cracks elsewhere, design changes should be directed at reducing the stresses at the position of failure, even though the stresses at other vital positions may be increased as a result. This requires the wall to be thickened, which would raise the temperature of the upper ring, but the tendency would be counteracted by the cutting of suitable grooves in the piston wall.

### Some Qualities Required

The qualities required in a material to resist failure by residual stress when used in engine components are given as follow:—(1) High-tensile strength, little affected by continued exposure to the working temperatures; (2) high ductility, little affected by small amounts of repeated plastic strain; (3) low Young's modulus in elastic range; low stress-strain ratios in plastic range; (4) low coefficient of expansion and Poisson's ratio; (5) high thermal conductivity; (6) high creep resistance. The qualities required to resist fatigue failure, in addition to a high fatigue strength, are identical with (3) to (5) inclusive. A high notched fatigue strength under mildly corrosive conditions is required in the range 50 to 250 deg. C. Low creep resistance is beneficial in this case, since creep allows the relaxation of the mean tensile stress.

## English Electric's Atomic Power Department

Establishment of a special department to deal with atomic power station development is announced by the English Electric Company, Limited. The headquarters of the company's atomic power work is at Whetstone, near Leicester, where the administrative, design, experimental, and drawing office staffs are already established. English Electric acquired the Whetstone premises of the National Gas Turbine Establishment last January.

Mr. P. H. W. Wolff, who has been appointed chief engineer of the atomic power department at Whetstone, was previously engaged on gas turbine development work for the English Electric Company at Rugby. He takes charge of a staff, a nucleus of which has undergone special training for development work on atomic power stations.

This announcement indicates that an important section of English Electric's engineering activity, including that relating to all prime movers, atomic power, and the new mechanical engineering laboratory, is now centred round Rugby. The main works are at Rugby, and the mechanical engineering laboratory is at Whetstone. Considerable expansion of technical staff and facilities is now taking place in the Rugby area, both for established products and new lines.

Dr. H. S. Arms, who is the chief engineer of the company at Rugby, is responsible for the overall technical policies to be followed by all departments at Rugby and Whetstone. Dr. Arms joined the company in 1953. From 1946 to 1950 he was principal Scientific officer in charge of the engineering laboratory at the Atomic Energy Research Establishment at Harwell. He was made assistant chief engineer in 1950, becoming deputy chief engineer in charge of research and development for the Capenhurst plant of the production division of the atomic energy department.

## New Iron and Steel Plant for Argentine

Construction has been started on a new steel plant for Argentina. Maj. Gen. Jose Manuel de Olano, chairman of the operating company, Sociedad Mixta Siderurgia Argentina, has stated that capital expenditure will be some $250,000,000, of which the Argentine Government's share is 80 per cent. As the company becomes established, the Government, it is stated, will gradually dispose of its holdings to private investors. The initial annual capacity of the General Manuel Savio Steel Works will be 500,000 tons of semi-finished steel. A contract for the first blast furnace, expected to be operating in 1957, has been placed with Arthur G. McKee & Company, two additional furnaces being planned. A battery of coke ovens by a German firm is expected to be in operation this year. Meanwhile, six open-hearth furnaces, each of 200 tons capacity will be supplied by a Continental firm. A strip mill ordered by Czechoslovakia, but impounded by the US Treasury and later sold to Argentina for $9,000,000, is to be completed and installed at the new plant. Orders for a blooming mill and soaking pits are being placed in the US, while a combination structural shape and rail mill will, it is expected, also be American. No bar or tube mills so far are planned. A proportion of the semi-finished steel output will be disposed of to other Argentine concerns for conversion into finished products. Some 25 per cent. of the country's steel requirements is expected to be met by the new works.

## Whitworth Foundation Awards

For many years the awards from the Whitworth Foundation have consisted of:—(*a*) Whitworth senior scholarships open to holders of degrees or higher national certificates or diplomas in engineering; (*b*) Whitworth scholarships open to engineering apprentices of at least two years' standing; (*c*) Whitworth prizes awarded to unsuccessful candidates for scholarships whose work deserves recognition.

Since these awards were instituted, the number of maintenance allowances and scholarships from public funds given to enable suitable students to obtain university degrees or to undertake other forms of full-time further education has greatly increased. This has had a marked effect on the entry for Whitworth scholarships examinations. At the same time, the need for post-graduate awards has increased.

In order to meet the changed conditions, the Minister of Education, as trustee of the Sir Joseph Whitworth Foundation, has decided to increase the maximum number of senior scholarships from two to three and to increase their value from £325 to £500 per annum (which may be supplemented by dependants' allowances). These awards will be available for post-graduate work and will, in future, be known as Whitworth Fellowships. In addition, a number of Whitworth prizes of greater value than previously will be awarded to unsuccessful but meritorious candidates for Fellowships. The award of ordinary Whitworth scholarships will be discontinued.

The new arrangements will take place in 1956. A pamphlet outlining the new rules and conditions can be obtained from the Stationery Office (3d.).

## Latest Foundry Statistics

As reported by the Ministry of Supply the output of aluminium-alloy castings during February was 1,715 tons as sand cast, 4,098 tons as gravity-die, and 1,419 tons as pressure-die-castings. The production of magnesium castings was 349 tons.

According to the April bulletin of the British Iron and Steel Federation, employment in steel foundries declined by 11 on March 5 as compared with a month earlier and by 83 as at the beginning of the year. The average weekly delivery of steel castings during February remained at the now virtually constant figure of 1,450 tons.

## Recent Wills

| | |
|---|---|
| HAWTHORNE, D. N., who was associated with Cannon Iron Foundries, Limited, Deepfields (Staffs) ... | £44,283 |
| DAWSON, T. H. H., formerly of Dawson, Bentley & Company Limited, ironfounders, of Keighley (Yorks) ... ... ... ... ... ... ... | £12,524 |
| COWLEY, S. O., late managing director of Bodill Parker (1922), Limited, brassfounders, of Birmingham ... ... ... ... ... ... ... | £12,766 |
| MUDFORD, CAPT. J. F. W., North-East Coast area training officer of the British Iron and Steel Federation ... ... ... ... ... ... | £18,593 |
| WIMPORY, CHARLES, late of Buck & Hickman, Limited, iron and steel stockholders, etc., of Birmingham ... ... ... ... ... ... ... | £11,397 |
| SEAGER, CAPT. J. H., former president of the Cardiff Chamber of Commerce and the Bristol Channel Shipowners' Association ... ... ... ... ... | £189,078 |
| WILDER, W. J., chairman of Walter Wilder & Sons, Limited, agricultural engineers and ironfounders, of Crowmarsh (Berks) ... ... ... | £39,762 |
| CHAMBERS, R. L., formerly assistant manager of C. & W. Walker, Limited, gasworks engineers and ironfounders, of Donnington (Salop) ... ... ... | £4,722 |
| GLOAG, MAJOR V. F., London director of Simon-Carves, Limited, manufacturers of coke-oven and gasworks plant, etc., of Stockport (Ches) ... | £16,415 |

# Maximum Prices for Scrap to Iron and Steel Foundry Casting Specifications

*The following table of official maximum scrap prices is reproduced from document S.I. 1955 No. 678 issued by H.M. Stationery Office*

| Specification (For delivery at consuming works in District). | Scotland (*see* Proviso (*a*) below) | Northumberland, Co. Durham, Middlesbrough and Thornaby | Cumberland, Barrow and Ulverston | Westmorland, Lancashire, Wallasey, and Birkenhead | York, and W. and N. Ridings (ex-Middlesbro. and Thornaby) | East Riding, and Kingston-upon-Hull Yorkshire | Derbyshire | Nottinghamshire | Lincolnshire | Cambridgeshire | Cheshire (exc. Wallasey and Birkenhead) | Anglesey, Caernarvonshire, Denbighshire, Flintshire, Merioneth, Mont. and Radnorshire | Shropshire, Staffordshire, Warwickshire and Worcestershire | Leicestershire Northamptonshire Huntingdonshire and Rutland | Norfolk | Suffolk | Wales—(Brecknock and Cards. and South); *and* Monmouth, Hereford-shire, Glos. and Bristol | Somerset, Dorsetshire, Wilts., Hants. and Sussex | Oxfordshire, Berkshire and Bedfordshire | Essex and Kent | County of London | Middlesex, Surrey, Hertfordshire and Buckinghamshire | Cornwall and Devon | Northern Ireland |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| 1. *Short Heavy Steel Scrap* consisting exclusively of rails, railway tyres, and fishplates—in cupola sizes not exceeding 2 ft. long | 166 6 | 166 9 | 166 6 | 164 0 | 169 0 | 169 0 | 169 0 | 169 0 | 169 0 | 169 0 | 164 0 | 161 9 | 161 9 | 166 6 | 166 6 | 166 6 | 169 0 | 161 9 | 161 9 | 161 9 | 161 9 | 166 6 | 161 9 | 166 6 |
| 2. *Short Heavy Steel Scrap* consisting of shearings, bar ends, constructional and similar scrap—not less than ¼-in. thick, in cupola sizes not exceeding 2 ft. long | 164 0 | 164 3 | 164 0 | 161 6 | 166 6 | 166 6 | 166 6 | 166 6 | 166 6 | 166 6 | 161 6 | 159 3 | 159 3 | 164 0 | 164 0 | 164 0 | 166 6 | 159 3 | 159 3 | 159 3 | 159 3 | 164 0 | 159 3 | 164 0 |
| 3. *Hematite Ingot Mould Scrap* in cupola sizes (price unchanged) | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 | 220 3 |
| 4. *Heavy Machinery* (*including Textile Machinery* (but excluding *Material covered by Specification* 12) *Cast-iron Scrap*, in cupola sizes | † 160 9 | † 169 3 | 153 0 | † 156 0 | † 163 6 | † 170 0 | † 166 0 | † 164 0 | † 156 6 | 151 6 | † 158 6 | 149 0 | † 170 9 | † 161 3 | 152 6 | 153 6 | 157 9 | 151 6 | † 155 9 | 151 6 | 148 9 | 149 3 | 141 9 | 151 3 |
| 5. *Ordinary Heavy Cast-iron Scrap*, not less than ½-in. thick, in cupola sizes | † 155 9 | † 164 3 | † 148 0 | † 151 0 | † 158 6 | † 165 0 | † 161 0 | † 159 0 | † 151 6 | † 146 6 | † 153 6 | † 144 0 | † 156 9 | † 156 3 | † 147 6 | † 148 6 | † 152 9 | † 146 6 | † 159 9 | † 146 6 | † 143 9 | † 144 3 | † 136 9 | † 146 3 |
| 6. *Cast-iron Railway Chairs* | = 155 9 | † 164 3 | † 148 0 | † 151 0 | † 158 6 | † 165 0 | † 161 0 | † 159 0 | † 151 6 | = 146 6 | † 153 6 | † 144 0 | † 156 9 | † 156 3 | = 148 6 | † 148 6 | = 152 9 | † 146 6 | † 159 9 | † 146 6 | † 143 9 | † 144 3 | † 136 9 | † 146 3 |
| 7. *Medium Cast Iron Scrap* consisting of gas stove plate, wringers, and similar scrap—in cupola sizes | † 143 9 | † 152 3 | † 136 0 | † 129 3 | † 143 6 | † 153 0 | † 151 9 | † 149 9 | † 139 6 | † 134 6 | † 141 6 | † 132 0 | † 153 3 | † 144 3 | † 135 6 | † 136 6 | † 140 9 | † 134 6 | † 138 9 | † 134 6 | † 129 3 | † 132 3 | † 124 9 | † 134 3 |
| 8. *Light Cast Iron Scrap*, in cupola sizes | † 136 3 | † 144 9 | † 128 6 | † 121 9 | † 136 0 | † 145 6 | † 144 3 | † 142 3 | † 132 0 | † 127 0 | † 134 0 | † 124 6 | † 145 9 | † 136 9 | † 128 0 | † 129 0 | † 133 3 | † 127 0 | † 131 3 | † 127 0 | † 121 9 | † 124 9 | † 117 3 | † 126 9 |
| 9. *Burnt Cast Iron Scrap and Firebars*, in cupola sizes | 112 3 | 119 6 | 117 0 | 113 3 | 117 0 | 117 0 | 117 0 | 117 0 | 118 6 | 118 6 | 111 9 | 117 0 | 119 6 | 114 6 | 113 0 | 115 3 | 121 9 | 112 0 | 116 9 | 107 3 | 109 3 | 107 3 | 102 3 | 109 3 |
| 10. *Short, Heavy or Crushed Steel Turnings*, free from — bushy, alloy, and non-ferrous metal | 124 9 | 127 9 | 129 9 | 122 9 | 126 0 | 126 0 | 126 0 | 126 0 | 126 9 | 126 9 | 127 9 | 127 9 | 121 0 | 126 9 | 125 9 | 125 9 | 128 9 | 121 0 | 121 0 | † 121 0 | † 121 0 | † 121 0 | | |
| 11. *Malleable Cast Iron Scrap*, in cupola sizes | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 | † 177 3 |
| 12. *Cast Iron Scrap being Motor Engine Cylinder Blocks or Heads*, free from — steel, and non-ferrous metal | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 | 206 0 |

Provided that:

(*a*) For *Cast Iron Scrap*, Specifications, 4, 5, 6, 7, 8, 9, and 11, arising in Scotland and for delivery at consuming works in Scotland, the maximum prices shall be—(1) for deliveries free on rail or free on lorry at loading point, the above prices for Scotland District *less*—(i) 3s. per ton; *and less* (ii) the excess (if any) of the actual cost of transport to consuming works over 12s. per ton; and (2) for deliveries free to consuming works, the above prices for Scotland District *less* 3s. per ton but plus—whichever shall be *the less*—(i) the actual cost of transport to consuming works, *or* (ii) 12s. per ton.

(*b*) Where delivery of scrap of any one Specification (exclusive of scrap under Specification 12) under an order of 50 tons and upwards is tendered in quantities of not less in the aggregate than 50 tons per three months, the maximum prices shall be the above prices increased by 2s. 6d. per ton.

# Foundry Problems and Principles*

## *Discussion of Mr. G. J. Rogers' Paper*

*In this discussion at a meeting of the London branch of the Institute of British Foundrymen, members expressed some puzzlement as to the efficacy of the methods chosen by Mr. Rogers for the solving of the several problems brought forward. Other topics included the procedure for making conveyor wheels, the risering adopted for the hydraulic casting, exothermic materials and chilling* versus *bottom pouring.*

MR. A. R. PARKES congratulated Mr. Rogers on producing so many interesting examples of practical foundry problems and asked whether in every case shown a stopper had been used on the top of the downgate.

MR. ROGERS, in reply, said a stopper had not been used in every case but he felt that where a job was of a size which warranted it, or where there was an important feature to safeguard, then it should be used. His view was that manganese-bronze, aluminium-bronze and nickel-bronze castings should always be stoppered, *i.e.*, "plugged."

### Effectiveness of Running Methods

A MEMBER said it was very evident that one must have consultation before making a casting rather than an inquest afterwards, but he found one or two of Mr. Rogers' methods a little confusing and in some cases it seemed that they were a little contradictory. One particular case was the half-bearing which was apparently being misrun or sinking at the top. Mr. Rogers had said that the cure was apparently due to the use of a spinner gate. It seemed hardly possible that that was in fact the reason why success had been achieved. His own view was that in the first instance there was insufficient running speed due to the fact that the riser allowed the metal to rise slowly and dictated the time at which the pressure became effective underneath. When the spinner gate was used and the riser was taken away, the running speed was increased and the temperature of the metal underneath was increased.

In the case of the Monel-metal plate, the method of running down the side and progressively using layer ingates was very interesting, but could Mr. Rogers say why he had finally put the top ingate in the casting instead of in the riser? It would seem that by running through the top ingate to fill the riser it would have increased the temperature of the latter.

MR. ROGERS, in reply, said that he had entertained very grave doubts with the whirlgate at the beginning, as to whether it would be effective, and only by trying it out had he found that apparently sound castings resulted. The speaker's remarks on the reason for its being sound were interesting, but he was still somewhat baffled because the section beyond the top of the casting was thicker than the section across the crown. It was one of those extraordinary things which seemed to happen with a whirlgate. It was accepted that the first metal which went over was not reheated and progressively froze from that side but, in general, it was a happening which appeared to be contradictory. Similarly, he would probably disagree very violently with other foundrymen over the so-called Connor runner, as he could not accept the notion that it would produce a really sound casting. Instead, he thought one got the same sort of conditions as in phosphor-bronze—a metal/mould reaction and microscopic gas porosity forcing the metal to the surface of the mould—and although the casting looked sound there was not the requisite density. He often wondered whether the whirlgate did in fact produce a dense casting. With regard to the Connor runner, he was never going to believe that it was possible to make a thick casting, by having only a $\frac{1}{8}$-in.-wide ingate into the top of it, and that such a casting could be adequately fed through that gate.

### Conveyor Wheels

To take an example, some thousands of conveyor wheels were being made in one foundry and they were being moulded by having a runner in the boss and one riser on the rim. The usual plated section joined the boss to the rim, and they weighed 80 lb. The suggestion had been made that production costs could be reduced by using a Connor ingate and so a number of them were tried, on the same machine and under the same conditions. When made using the Connor gate the castings weighed 76 lb. each—4 lb. less than when made in the traditional manner. It was possible that the whirlgate acted in much the same way—the shrinkage cavity was being eliminated and there did not appear to be porosity because it was being spread over the whole casting.

THE MEMBER said that, surely, in the original illustration the head pressure was still not obtained quickly enough. The metal was being run through but the casting rate and the pressure effect were being slowed down.

MR. ROGERS said he did not understand the reference to pressure. Even when the green-sand mould was filled, all the metal was still liquid, and

* Paper printed in the JOURNAL, May 19.

it was difficult to see where the question of insufficient pressure applied. There was an open riser on the other side and therefore one had gravity feed on both sides and it should be pushing the metal up to the crown.

Replying to the point about the Monel plate, Mr. Rogers said in making steel castings the secret was to get rid of hot spots because the metal was very weak indeed just at the point of freezing, and that was where hot-tears occurred. Similarly, in the case of Monel—a metal having such a regular and short freezing range, chills on both sides all the way up—a complete riser right across and the highest ingate at the top of the plate were recommended. It was considered unnecessary to put a further ingate even higher, although he agreed entirely that the best way was to get the last drop of hot metal into the riser.

MR. G. C. PIERCE, referring to the temperature of the Monel metal, said Mr. Rogers had mentioned that the melting temperature was 1,560 deg. and the job was poured at 1,500 deg.—what was the method of checking the temperature of that metal; was it with a base-metal couple?

MR. ROGERS replied that the method adopted was by means of a radiation pyrometer, to which MR. PIERCE retorted that such a method, in his opinion, was useless.

### Hydraulic Casting

A MEMBER said that in connection with the hydraulic-pump casting he was very puzzled as to why a good casting had been obtained with the method used. It appeared from the illustration that, in fact, the casting would be feeding the riser block at the point of attachment, and it did not seem to make sense at all.

MR. ROGERS, in reply, said in the branch leading out to the flange the thickness was very much less than the flange itself. What had been done was to chill the flange completely with cast-iron chills and to place a feeder above it. The main feed for the branch was merely coming down through the body, and as one could not chill everywhere he did not think the method was, in fact, contradictory. It was simply the application of the principle of promoting the freezing of a localized heavy part, and the ensuring of a supply of feeding metal.

MR. MANTLE, referring to the whirlgate, said he did not quite know what the depression in the top was like, but was it possible that the casting had been poured so fast in the first instance that a pocket of air was trapped at the top and slower pouring with the whirlgate allowed the air to get through the mould?

### Centre-line Shrinkage

With regard to the crystal cleavage, or as he himself termed it, centre-line shrinkage, he wondered whether the castings had been poured at an exceptionally high temperature. In his opinion there were various ways in which the difficulty could be overcome, apart from the chilling suggested by Mr. Rogers which might often be expensive. With brass it might be possible to do something by grain refining, by adding a modicum of iron to the alloy. It was also worth bearing in mind that moulding sands had very different cooling powers from one sand to another; an open sand had relatively high cooling power compared with close-grain sand. Where a sand with a high cooling power was used, perhaps a refractory dressing on the mould to act as an insulator might reduce the rate of heat extraction sufficiently to prevent this coarse columnar structure and centre-line shrinkage.

With regard to the last illustration, it was certain that a dry-sand mould had a very much less cooling effect than a green-sand mould, and in that respect an oil-sand core was very much like dry sand. That would account for the differences in properties shown.

MR. ROGERS said with regard to the flange castings, it was impossible to add iron because of the difficulties in brazing which the coppersmiths would immediately encounter. Where hundreds were being made continuously one just could not wait for temperature checking; in other words one wanted a method enabling the man to carry straight on and cast. While he agreed that the temperature could be reduced to a large extent—with consequential increased production costs—the same tendency persisted and the only effective way found was to insert copper nails into the bottom of the mould and so set up centres of freezing.

DR. O. P. EINERL suggested that the best way to assess the casting temperature of molten Monel metal was to dip in a mild-steel rod: when it melted one had the right temperature.

MR. W. G. MOCHRIE said Mr. Mantle had confirmed his own opinion as to the method of running a small brass plate, the method had worked particularly well and had eliminated the " sandwiching." So far as the iron addition to brass was concerned, the amounts to which Mr. Mantle had been referring were no more than microscopic inclusions.

With regard to the half-bearings, his own view was that the whirlgate had nothing at all to do with it. On a half-bearing slightly smaller than that shown by Mr. Rogers he had experienced exactly the same thing when two feeders had been employed, but as soon as one of the risers was removed a perfectly sound casting was obtained.

### Exothermic Materials

MR. B. LEVY asked whether Mr. Rogers had had any experience with exothermic materials. He had noticed that all the runner systems were based on good old-fashioned methods which seemed somewhat extravagant in these days with the high cost of metal.

MR. ROGERS said he most certainly had experience of exothermic materials and he was all in favour of them. It used to be necessary to make the riser much longer and to put a much bigger head on before such materials were used. In actual fact, he could talk a little about exothermic materials before they even came on to the market as a commercial proposition; probably other foundrymen could do the same. Some years ago, before exothermic materials were

marketed, he had some very big cast-steel anvil blocks to make and the method used was to fix a piece of rod into the riser and wire to the end of it a piece of aluminium. It was amazing the exothermic reaction which resulted. Exothermic materials were most effective and he always recommended the use of them whenever suitable.

### Chilling v. Bottom Pouring

MR. RUCK said in the illustration shown of a casting of a large-diameter ring there was a mass of metal running over a very-heavily-chilled section, with large feeder heads on the top, with the idea of getting directional solidification. He could not understand the purpose of running a mass of hot metal over a large chilling area. The hot metal first entering the mould would be directly chilled to a certain extent and that would go up into the riser; bearing in mind that one wanted the hottest metal at the top, one was thereby preventing a temperature gradient throughout the casting.

MR. ROGERS said if that view was held, one would never bottom-run any job at all, because the hottest metal would always be in the bottom. Where one had aluminium alloys, manganese-bronze, and the like, which became oxidized with turbulent running, then it was essential to bottom-run. All such castings were poured so that the metal came up quietly and flowed around the mould. It should be noticed that the chills in the base of the casting shown were much heavier than they need have been for a section of that sort, the reason being that as the job was bottom-poured, there must be more heavier chilling in order to counter that fact. Again, a supplementary ingate leading into the riser, or "topping-up" directly into it, was normal practice in any sizeable job, where bottom-running had to be applied.

### Monel-metal Casting

MR. E. DAYBELL, referring to the Monel-metal casting, asked whether Mr. Rogers was satisfied that the runner with the three ingates on the side worked as he had explained it. It had apparently been proved in the naval yards of America that in fact that was not the case, and there was another method of doing the job. Also, why did Mr. Rogers depart from his conventional feeding head on the Monel metal job which he had been so emphatic should be used on all the others?

MR. ROGERS, in reply, said he agreed entirely about the shape of the ingates. In all normal cases there should be progressive feeding into ingates running upwards, but in that particular case a metal was being cast in which there was not very much fluidity at the best of times, and also, in addition, it was an alloy subject to severe oxidation. Therefore, rather than risk a sort of semi-choking in the runner, the method described was adopted. In this case, the mould had to be filled as quickly as possible.

With regard to the riser, the particular casting had been moulded flat, then secured and put up on end for casting. Unfortunately, on previous occasions, porous places were found in the plate on being tested to 1,200 lb. per sq. in. pressure, after the machining. That was because the section was parallel, as cast. The tapering of the casting section, as shown by the slide, had proved to be the means of obtaining soundness, with all the metals of short freezing ranges and/or heavy liquid contraction rates.

### Vote of Thanks

MR. PIERCE, proposing a vote of thanks to Mr. Rogers, said it had not only been an interesting lecture, but Mr. Rogers had really got down to earth and dealt with a number of problems which many foundrymen had met a number of times. Undoubtedly, it was the type of lecture which would interest the vast majority of people who earned their living in the foundry industry.

The vote of thanks was seconded by MR. BARTLETT and carried with acclamation.

MR. ROGERS, in reply, said it was quite a new venture for him to be lecturing, but he felt that those dealt with were the sort of subjects that the members of the Institute should be discussing. They ought not to be afraid to put their cards on the table with regard to methods individually adopted, because, after all, members of the foundry industry need not fear competition between themselves in this country. In the years to come, there would be intensified competition from foreign countries, and if foundrymen were going to stick to the same old methods of moulding and melting because they were afraid to venture into new fields and tackle new theories, then this country would deserve what it would undoubtedly get.

It might interest members to know that he had been president of an organization of all the Admiralty technical officials of all branches for thirteen years, so he could claim to know what he was talking about in connection with the technical trades, and he knew the relation of one to the other. There was, of course, no trade as important as the foundry, and so he had felt it a great honour that as a foundryman he had been able to lead 2,000 Admiralty officials in their deliberations.

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**IBF List of Members**

Members of the Institute of British Foundrymen are reminded that duplicated copies of the list of members are now available for purchase at £5 5s. 0d. per copy.

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THE INTERNATIONAL FOUNDRY CONGRESS in June will be attended by about 1,000 people coming from 20 countries.

CATTON & COMPANY, LIMITED—Mr. S. L. Finch has been appointed joint managing director, together with Mr. A. H. Catton and Mr. D. E. Catton. Mr. A. H. Catton remains chairman of the company.

GLENFIELD & KENNEDY, LIMITED—Mr. E. Bruce Ball has resigned his appointment of managing director of the company and from the boards of Glenfield & Kennedy Holdings, Limited, and associated and subsidiary companies.

# Company News

PATERSON ENGINEERING COMPANY, LIMITED—An ordinary dividend of 25 per cent. for the year 1954, compares with a dividend of 15 per cent., equivalent to 22½ per cent. per annum, for the previous eight months' period.

WORTHINGTON-SIMPSON, LIMITED, manufacturers of pumping machinery, condensing plant, etc., of Newark (Notts)—Incoming business for the first quarter of 1955 is reported to be higher than for the corresponding 1954 period. Trading profit for 1954 was £652,202, against £642,689 for 1953.

CRAVEN BROS. (MANCHESTER), LIMITED, machine-tool makers, ironfounders, etc.—The recent issue of 800,000 5s. ordinary shares at 12s. 6d. per share has been heavily oversubscribed. The basis of allotment was as follows:—Up to 50 shares in full; 51 to 400, 50; 401 to 10,000, 12½; over 10,000, 7½ per cent.

LIGHTALLOYS, LIMITED—No interim payment is to be made on the £120,000 one-class capital for the year to June 30, 1955. Last year's interim dividend of 2½ per cent. was followed by a final payment of 8½ per cent., giving a total of 10 per cent. for 1953-54, compared with 17½ per cent. for the previous year.

HEAD, WRIGHTSON & COMPANY, LIMITED—The company is paying a final dividend of 12½ per cent., making 17½ per cent. for the year to January 31 last on £1,181,250 ordinary capital as doubled by a free scrip issue, compared with a forecast total of at least 12½ per cent., the previous year's equivalent payment. Group trading profits on completed work rose from £887,358 to £1,028,397, all the increase being attributable to the parent company.

DUNLOP RUBBER COMPANY, LIMITED—The company is issuing the 12,000,000 of second debenture stock 1972-82 at 97½. The final payment of 47½ per cent. is due on September 30. A first interest payment of £1 2s. per cent. will be made on October 31 next and thereafter on April 30 and October 31. The average consolidated profits of the company and its subsidiaries for the three years ended December 31, 1954, after all charges amounted to £6,997,157 before charging UK taxation.

GIBBONS (DUDLEY), LIMITED, makers of gas retorts and refractories, of Dudley (Worcs)—A final dividend of 6 per cent. on the £401,240 ordinary capital as increased by a 150 per cent. free scrip issue, makes with the interim of 10 per cent. paid prior to the issue, a total equivalent to 10 per cent. for 1954 on the present capital. This compares with the equivalent of 8 per cent. for 1953, when the total was 20 per cent. on £160,496, and takes £22,670, against £17,654. Group profits, before taxation, expanded from £245,497 to £325,767.

## Still Fewer Unemployed

With the exception of April, 1951, the number of unemployed in Great Britain at the end of last month was the lowest April figure recorded since the war. There were 260,000 workers registered as unemployed on April 18, representing only 1.2 per cent. of the total number of employees. This was 10,000 less than on March 14, and 56,000 less than in April last year. Of the 260,000 unemployed, only 105,000 had been out of work for more than eight weeks. There were approximately three jobs available for every worker unemployed for more than two months.

In the month up to April 18 the engineering and vehicles group of industries gained 6,000 workers. In the first quarter of this year there was a rise of 3,000 in the number of wage-earners on colliery books.

## BMC Appointments

The British Motor Corporation has made a number of appointments and promotions with a view to creating close co-ordination of the activities of the constituent companies of the group.

Mr. Arthur Keats, chairman and managing director of Fisher & Ludlow, Limited, has joined the board of the parent company.

Mr. J. F. Bramley, Mr. J. R. Edwards, and Mr. S. J. Wheeler have joined the board of the Austin Motor Company, Limited, following service as local directors. New local directors of the Austin Motor Company are:—Mr. A. J. Burton, Mr. G. A. Durant, Mr. J. Tatlow, and Mr. G. C. Tuck.

Mr. J. R. Woodcock becomes deputy managing director and Mr. G. M. Palmer a director of Morris Motors, Limited, both having served as local directors. New local directors of Morris Motors are:—Major-General E. H. Clayton, Mr. W. E. A. Cullum, Mr. E. C. Dickinson, Mr. L. W. Hewson, Mr. J. W. Malone, and Mr. T. Sangster.

To strengthen its organization, the British Motor Corporation is forming groups of executive directors who will be freed from day-to-day departmental responsibilities. Among the heads of these groups will be Mr. Donald Harrison, a director of Morris Motors, Limited, who has been appointed director of home sales for BMC; Mr. J. F. Bramley, a director of the Austin Motor Company, Limited, who becomes director of export sales, and will be responsible for all BMC exports; Mr. H. C. R. Mullens, a director of Morris Motors, who has been appointed director of CKD exports for the Corporation; Mr. J. R. Edwards, a director of the Austin Motor Company, who becomes director of manufacturing for the Corporation, with responsibility for manufacture both at home and abroad, and Mr. G. A. Durant, a local director of the Austin Motor Company, who has been appointed director of supplies for the Corporation. Technical appointments announced by BMC are Mr. G. M. Palmer, a director of Morris Motors, as technical manager, Mr. W. V. Appleby as chief engine designer, and Mr. H. King and Mr. G. Argyle as joint chief commercial vehicle designers.

## Mond Nickel Company

The Mond Nickel Company, Limited, announces the following management changes:—

MR. L. K. BRINDLEY has been elected deputy chairman of Mond Nickel and Henry Wiggin & Company; MR. G. ARCHER has been elected managing director of Mond Nickel; MR. I. A. BAILEY is moving his headquarters from Birmingham to London where he will continue as a director of Mond Nickel and as managing director of Henry Wiggin & Company; DR. L. B. PFEIL, FRS, has relinquished the managership of the development and research department in order to devote himself more fully to directorship responsibilities; MR. R. A. R. HILL has been elected a director of Mond Nickel and to the offices of comptroller of Mond Nickel and of Henry Wiggin & Company; MR. F. B. HOWARD-WHITE has been elected a director of Henry Wiggin & Company and secretary of Mond Nickel and of Henry Wiggin & Company; MR. J. O. HITCHCOCK has been elected a director of Mond Nickel and appointed sales director; MR. F. DICKINSON has been appointed manager of the development and research department.

MR. A. P. HAGUE continues as a director of the Mond Nickel Company and Henry Wiggins & Company and DR. A. G. RAMSAY as a director of the Mond Nickel Company, resident in South Wales.

# Building Contracts—Effect of Scarcity of Labour on Contract Price

*By "Barrister-at-Law"*

An important case affecting the law of contracts, particularly in relation to building contracts, has recently been engaging the attention of the Courts. The latest phase of these proceedings, contained in the decision recently given by the Court of Appeal in respect of Davis Contractors, Limited, *v.* Fareham UDC, is of interest to founders who are extending their premises or involved in other new or reconstruction work.

Two points were involved in this case: first, the proper construction of a clause in the contract, providing that the tender made by the builders was "subject to adequate supplies of material and labour being available as and when required to carry out the work specified"; second, the application of the doctrine of frustration to the circumstances of the case.

The point directly in issue was whether the building contractors were entitled to recover a sum in excess of the contract price, because of the fact that owing to scarcity of skilled labour, the work had taken 22 instead of eight months to complete.

### Facts of the Case

The facts were these: The defendant Local Authority had entered into a contract with the plaintiffs for the erection of 78 houses within a period of eight months for a price fixed by the contract subject to certain adjustments. It was contemplated by the parties that adequate supplies of labour would be available, and the tender of the contractors had been subject to the qualification as to the availability of labour in the terms stated earlier. In fact, owing to the scarcity of skilled labour, the work had taken 22 instead of eight months to complete. The builders claimed that in the circumstances the contract was to be treated as having been brought to an end, so that they were no longer bound by the price agreed, but were entitled to charge an extra sum to compensate them for the extra cost occasioned by the delay in the execution of the work.

The two main points for consideration were the question of construction and the application of the doctrine of "frustration."

In the view of the Court of Appeal, the clause in question referred only to the *time* of completion and not to the contract price. What the clause meant was that if the work took longer because of the non-availability of labour, the contractors were to be released from the obligation imposed on them to complete the work within eight months. The prolongation of the completion of the work accordingly did not entitle them to claim payment of a larger sum.

The second point is one of greater importance, for it relates to the general principle of frustration in relation to contracts. The doctrine of "frustration" has been considered in a number of cases. The principle is well settled, but its application to the facts of a particular case is difficult. The principle applies where, after the making of the contract, so fundamentally-different a situation arises (one never anticipated), that the parties must be regarded as having contracted on the footing that the contract was not to apply, and that neither party was to be bound in such circumstances. On the other hand, the fact that some unanticipated event occurs (which throws a greater burden on one of the parties in the performance of the contract) does not entitle that party to say that the contract is at an end.

As Viscount Simon pointed out in another case—British Movietones, Limited, *v.* London & District Cinemas, Limited, 1951, 2 A.E., at p. 625—"The parties to an executory contract are often faced, in the course of carrying it out, with a turn of events which they did not at all anticipate—a wholly abnormal rise or fall in prices, a sudden depreciation of currency, an unexpected obstacle to execution, or the like. Yet this does not in itself affect the bargain they have made." Lord Asquith pointed out in a further case—Sir Lindsay Parkinson & Company, Limited, *v* Works & Buildings Commissioners, 1950, 1 A.E.R. 208, 227—that in most cases of "frustration," the supervening event is a catastrophic one, caused by the act of neither party destroying some basic though tacit assumption on which the parties have contracted, and with that assumption destroying the contract itself."

The question in each case is whether the supervening event is "catastrophic,' so as to destroy the basis of the contract, and accordingly the contract itself. In the first case mentioned in this article, the Court of Appeal held that the shortage of labour, which was not due to the fault of either party, was not a "catastrophic" event, such as to put an end the contract and thereby enable the builders to claim a larger sum than the contract price.

### Another Example

It was sought on behalf of the contractors, however, to justify the increase on the basis of the principle of the decision in a third case—Bush *v.* Whiteman Trustees (1888). In this case, Bush had agreed in June, 1886, with the Whiteman Trustees to build a water main in the Lake District for £1,335. Bush made his tender on the footing that the work, which was to be completed in four months, was to be done in the dry, summer months. The Trustees, however, failed to give him possesion of the site until October 6, with the result that the work had to be done in the winter months instead. The contract expressly provided that, if the site was not made available in time, the contractor was to be entitled to an extension of time, but not to an increase of payment. The Court, however, notwithstanding this express clause, held that Bush was

*Building Contracts*

entitled to an extra payment. The ground of this decision was that the conditions of the contract had so completely changed because of the default of the Trustees in handing over the site, so as to make these special provisions of the contract applicable. This failure on the part of the Trustees to deliver the site did not expose the Trustees to a claim for damages at the expense of the contractor, since the Trustees had expressly safeguarded themselves by the clause against such a claim, but, on the other hand, it had so altered the condition of things that it was not reasonable or just to hold to the original contract.

Other examples can be given of another well-established principle of the law of contracts, that a party is not to be allowed to take advantage of a condition brought about by himself. This principle differs from the principle of "frustration," in that the contract itself contemplates and anticipates the supervening event, and makes provision for it in some way or other. However, if in such a case the supervening event is brought about by the conduct of one of the parties, and a fundamentally-different situation arises in consequence, the party in default will not be allowed to take advantage of the new situation to the detriment of the other party, when it would be unreasonable and unjust to allow him to do so.

In Davis Contractors, Limited, *v.* Fareham UDC, as the difficulties of the labour situation were of a national character and were not in any way due to the conduct of the local authority, the application of the principle of Bush's case did not arise, and the extra charge could not be justified on that ground. There was an attempt, however, to say in this case that the council had been responsible in some way for the shortage of labour, because it had licensed or commenced a great deal of other work at the same time; but the finding of fact that the trouble was caused by the national shortage of building labour at that time due to the unavoidable and unforeseen lag in demobilization, clearly negatived any such charge against the local authority.

## Metrovick Electronics Department

A new electronics department formed by the Metropolitan-Vickers Electrical Company, Limited, Trafford Park, Manchester, incorporates the present radio department, part of the marine and special contracts department, and the service electronics section of the industrial electronic control engineering department. The industrial section of industrial electronic control engineering department has been renamed industrial process control engineering department.

Mr. E. T. W. Barnes, formerly superintendent of the radio department, has been appointed superintendent of the electronics department, with Mr. D. E. Thornhill as assistant superintendent. Formerly chief engineer of the radio department, Dr. L. W. Brown becomes chief engineer of the new department, while Mr. T. R. Goode has been appointed assistant chief engineer and Mr. J. L. Russell, assistant chief engineer (special applications). Sales manager for the department is Mr. L. H. J. Phillips, previously sales manager of the radio department, with Mr. J. Nicholson as assistant sales manager. Mr. G. W. G. Canter, formerly manager, marine and special contracts department, has been appointed manager, special contracts, and will be located in London.

## Papers for 1956 IBF Conference

The Council of the Institute of British Foundrymen is prepared to receive offers of papers for presentation at the 53rd annual conference to be held in June, 1956. Members and non-members who contemplate offering papers are asked to communicate immediately with the secretary of the Institute, who will forward them a copy of the Institute's publication "Notes for the Guidance of Authors of Papers." It is desirable that all formal offers of papers should be sent in not later than June 1, so that they can be considered by the meeting of the appropriate committee which will be held later in that month.

MANGANESE BRONZE & BRASS COMPANY, LIMITED—Mr. Ernest Robson has been appointed deputy managing director.

## Allotment Basis of English Steel Offer

In connection with the offer for sale of 5,000,000 5¼ per cent. cumulative redeemable preference shares and £5,000,000 4½ per cent. debenture stock, 1974-79, in the English Steel Corporation, Limited, Sheffield, the Iron and Steel Holding and Realization Agency announced that about 28,000 applications were received for a total of approximately 16,350,000 preference shares. Those who applied for 100 shares received allotment in full. Applicants for more than 100 shares received approximately 20 per cent. of the amount applied for with a minimum of 100 shares.

In the case of the debenture, the number of applicants was approximately 8,600 for a total of approximately £12,850,000. The full allotment extends to applications for up to and including £1,000; over that, the allotment is approximately 25 per cent., minimum of £1,000.

## Silicon Steel Plant Project

Some £2,000,000 is to be spent by the Steel Company of Wales, Limited, on plant to make more silicon steel at its Orb Works, Newport. The project is designed to bring Newport more into line with United States competitors, and there will be a substantial rise in manpower. The new plant will enable the company to make silicon steel in coil form.

The company will instal continuous furnaces, high-temperature coil annealing furnaces, and special processing lines as soon as the project is approved by the Iron and Steel Board and the Iron and Steel Holding and Realization Agency. The Newport works, which first made steel in 1898, now employs 2,400.

PRICES of basic materials used in British industry showed another slight overall decline during April, when the Board of Trade's index (June 30, 1949 = 100) declined by 1.1 per cent. to 149.2. This was mainly on account of a fall of 6.6 per cent. in copper prices. The price of tungsten ore decreased by 10.6 per cent. The indices measuring changes in the prices of materials used in the mechanical engineering and electrical machinery industries both fell during the month, primarily due to lower prices for copper and brass items.

## New Catalogues

**Industrial Trucks.** Brush Coachwork, Limited, Falcon Works, Loughborough, have issued a booklet carrying humorous illustrations, thereby detracting from the well-written text, which sets out the advantages of battery-type electric industrial trucks. Interesting data are submitted showing very favourable cost comparisons with petrol trucks. Interested readers should write to Loughborough for this booklet.

**Nickel Alloys in Electronic Valves.** A new publication, issued by Henry Wiggin & Company, Limited, describes and illustrates some of the uses of wrought nickel and nickel-alloys in electronic valves. Tabular data on physical and electrical properties demonstrate the suitability of the various grades of wrought nickel to meet specific requirements in individual components. Copies may be obtained from the publications department of the company at Thames House, Millbank, London, S.W.1.

**White Metal and Tin Melting Pots.** A leaflet received from the Hoyt Metal Company of Great Britain, Limited, Deodar Road, Putney, London, S.W.15, illustrates and describes an electrically-heated transportable tilting furnace of 1-ton capacity for melting zinc. On the reverse side of the leaflet details are given of a range of five furnaces, with capacities rising from 1 cwt. to 1 ton, of the electrically-heated bale-out type for handling tin, white-metal and the like. With this other trade matter covering allied subjects was received. Copies of this leaflet are obtainable on application to Putney.

**Manufacture of Heavy Capital Equipment.** This is the title of a very pleasing brochure received from Ashmore, Benson, Pease and Company, Stockton-on-Tees. It consists mainly of clear photographs of the various shops and plant manufactured, each illustration carrying succinct explanatory captions. In the case of the foundries, however, a rather lengthier story is given. There is, the reviewer believes, one slight mistake in the claim of the company to be the first firm to make Meehanite in Britain. Surely, this was a Scottish firm? The writer congratulates those responsible for having produced a really excellent piece of publicity.

**Foundry Dust and Fume Removal.** An eight-page, well illustrated pamphlet (No. 6509) dealing with foundry dust and fume removal has just been issued by the Sturtevant Engineering Company Limited, Southern House, Cannon Street, London, E.C.4. It appears opportunely as being something of an epilogue to the recent Harrogate Conference on the subject. In the main the subject is covered by means of illustrations. The plant so dealt with includes the fettling shop, knock-out, pouring runways and stations; mould conveyor tunnels, dust collectors, vacuum cleaners and the heating of foundries. A second pamphlet (No. 6507) received, "Pneumatic Dust Collecting and Conveying," covers a number of industries, including the foundry. Both these are available on writing to Southern House.

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AT Leeds Assizes a claim for damages by Henry Hutchinson (35), of Baildon Street, Sheffield, against the English Steel Corporation, Limited, was dismissed. Hutchinson injured his right hand when he slipped after adjusting the cut of a lathe. The corporation denied all allegations of negligence and claimed that Hutchinson failed to pay proper attention to his work.

## Dover Accident Case

At Dover County Court, before Judge John Neal, Gordon G. Fellows claimed £75 damages from his employers, Dover Engineering Works, Limited, for burns on the small of the back while assisting to pour metal into a mould. It was stated that the accident took place in May, 1953, when Fellows was a trainee moulder. For him it was alleged that the accident occurred through the negligence of other men, or through the bad layout around the moulding box. Laurence Whittaker, called as an expert witness, said that he would not have allowed the pattern board so near the moulding box.

Charles W. Hawkins, works director, said he had been connected with foundries for 32 years and had visited them in this country and abroad. The moulding boxes were put down where the men wanted them and no instructions were given as to the distance of the pattern boards. They left it to the men. He said that the company co-operated with the factory inspector and although everyone was careful and the system was good it was possible for metal to fly and it frequently did so. It was impossible to prevent this.

Giving judgment for the defendant company, the Judge said that Fellows' evidence had impressed the Court, but he had failed to satisfy them that the injury was caused by negligence on the part of employees, or through a bad system of working. It was a pity, he said, that the case had taken so long to come before the Court. It increased the plaintiff's difficulty in proving his case, and increased four-fold the defendant's difficulty in answering it. He respected the opinion of Mr. Hawkins and thought that the crux of the matter was as he said —that it was impossible to stop metal flying about. He dismissed the claim, with costs against the plaintiff.

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## Damages Awarded to a Die-caster

An Airdrie foundry worker, who was seriously injured by molten metal while employed at the die-casting foundry of Vactric Limited, at Newhouse Industrial Estate, Lanarkshire, was on May 11 awarded £637 10s. damages against the company by a jury in the Court of Session. The injured man, Francis McConville, who sued his employers for £2,000, stated that as a result of the accident he was unfit for work from August 2, 1951, until August 14, 1952. The plaintiff, who described himself as a die-caster, blamed his employers for failing to protect scrap metal from moisture. The defenders, who denied liability, said he was not a die-caster but a furnaceman. They maintained that a short time before the accident the plaintiff had been cleaning his ladle with red ochre and water and they believed that he inserted his ladle, when still wet, into the molten metal, causing an explosion. The jury, who were presided over by Lord Strachan, assessed total damages at £850 and apportioned blame 75 per cent. to the defenders and 25 per cent. to the plaintiff.

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GRIFFIN & GEORGE, LIMITED, the laboratory furnishers and manufacturers of scientific apparatus, will occupy stand No. 8D in the forthcoming British Instrument Industries Exhibition at Earls Court, which opens on June 28.

THE INSTITUTE OF BRITISH FOUNDRYMEN has been invited to arrange an official visit of members to the Engineering Marine and Welding and Foundry Trades exhibitions to be held at Olympia in September. It is anticipated that the date of the Institute's official visit will be Monday, September 5, and tickets will be issued to all members in due course.

# News in Brief

A SECOND 370-ton open-hearth steel furnace has been put into operation at the Lenin Works at Nowa Huta, in Poland.

THE 1956 Foremen's Training Course of the Institute of British Foundrymen will be held at Harrogate from April 5 to 7.

THE PLANS of the Grahamston Iron Company, Limited, Falkirk, to erect extensions to the Queen Mary warehouse at Falkirk have been approved.

COLVILLES, LIMITED, are to build an electricity substation at Ravenscraig, Motherwell, the site of its £20,000,000 steel extension scheme, at a cost of £15,000.

STEEL SUPPLY COMPANY (EASTERN), LIMITED, 15, Goldington Road, Bedford, announce that the structural department is now under the control of Mr. M. H. A. Barry.

ROBERT HARLOW & SON, LIMITED, Stockport (Ches), has despatched a consignment of standard cocks and valves to the Seychelles for the refitting of a cinnamon-leaf distillery plant.

BAKELITE, LIMITED, on stand No. 74 at the Plastics Exhibition, June 1 to 11, 1955, at Olympia, London, will include an array of foundry shell-moulds and cores based upon bakelite resins.

AFTER visiting London and Glasgow the Vokes Exhibition, which presents a comprehensive display of products of the Vokes group of companies, returned to Birmingham from May 20-25.

ABOUT 1,200 employees of J. Blakeborough & Sons, Limited, valve manufacturers, of Brighouse (Yorks), are to receive bonuses totalling £25,000 for 1954, the most prosperous year in the company's history.

THE average selling prices for April of member firms of the Federation of Light Metal Smelters, calculated to the nearest 10s., were:—LM1, £183 per ton; LM2, £184 10s.; LM4, £186 10s.; LM6, £189 10s.

AN EXTENSION has been opened to the works of the Fullwood Foundry Company, Limited, at Burnbank Road, Hamilton (Lanarkshire). The extension consists of baths and a laboratory, and cost £22,000.

JAMES DICKIE & COMPANY, (DROP FORGINGS), LIMITED, Ayr, are to erect a new patternshop and laboratory at a cost of £7,000, and another building at a cost of £2,300 to be used as an assembly shop and store.

AS A RESULT of the visit of the Soviet Ambassador Mr. Malik, to the Birmingham section of the British Industries Fair, the city has been asked to send, for the first time, civic and industrial representatives to lunch at the Soviet Embassy.

A BUENOS AIRES report states that Argentina and Belgium have signed a barter agreement providing for the exchange of $10,000,000 worth of Argentine wool against a like amount of unworked iron and steel from Belgium and Luxembourg plants.

CONSOLIDATED PNEUMATIC TOOL COMPANY, LIMITED, of 232, Dawes Road, London, S.W.6, announce that they have entered into an agreement to take over virtually world-wide representation for the Hemborn range of dustless dry-drilling equipment.

THE ANNUAL PROSPECTUS of the courses held at the National Foundry College is now available and copies may be obtained by those interested on application to the Principal of the College, Mr. J. Bamford, B.SC., Wulfruna Street, Wolverhampton.

ACCORDING to *Fabrimetal*, the production of iron castings in Belgium in 1954 rose to 243,970 *tonnes*. In 1953 it was 236,303 *tonnes*. The corresponding figures for steel castings were 1,086 and 1,203 *tonnes*. In this section, Belgian foundries have to meet the competition of French imports.

THE SCOTTISH OFFICE and service depot of the Atlas Diesel Company, Limited, is now at 591, Nitshill Road, Glasgow, S.W.3 (telephone: Barrhead 2346/8). The South Wales office of the company has also been transferred to bigger premises—at 27, Wyndham Crescent, Cardiff (telephone: Cardiff 31161/3).

REPRESENTATIVES of the British Engineers' Association, headed by Mr. H. S. "Dick" Broom, president, recently visited the headquarters of the North Atlantic Treaty Organization in the Palais de Chaillot, Paris, and at the invitation of General Gruenther, Supreme Headquarters Allied Powers Europe, near Fontainbleu.

FOLLOWING the death of Dr. Hentschel, the new management of Schloemann A.G., Düsseldorf, the German suppliers of heavy steelworks equipment, is composed of Dr. Ing. Bernhard Knapp, Vorstrand, Dr. jun. Arnold Huyssen, stellvertretendes Vorstandsmitglied, and H. P. Lemm, stellvertretendes Vorstandsmitglied.

LAND PYROMETERS LIMITED, of Sheffield, announce the opening of a branch office in London on July 1, at 227, Holland Park Avenue, Shepherds Bush, W.11 (telephone: Park 3633). At the same time, Mr. I. H. Gordon, who has for many years been associated with industrial instruments, joins the firm as southern-area manager.

SIR GEORGE BARNETT, Chief Inspector of Factories, told the Scarborough conference of the General Federation of Trade Unions that he was expecting to get from the Industrial Health Advisory Committee of his department a directive to carry out surveys and field investigations which the committee considered important from the aspect of industrial health.

VICKERS-AMSTRONGS, LIMITED, Walker-on-Tyne, have received an order for two single-screw turbine-driven cargo liners of 11,500 tons displacement each from Furness, Withy & Company, Limited. The propelling machinery for the new vessels will consist of steam turbines developing 7,700 s.h.p. to be supplied by the Parsons Marine Steam Turbine Company, Limited.

AT Woods of Colchester, Limited, staff and visitors watched the assembly and testing of the millionth fan in the firm's machine-number record. The final nut was formally tightened by Mr. A. E. Watson, a director of J. T. Meredith & Company, Limited, the consulting engineers who ordered the fan, a 48-in. dia. two-stage Aerofoil unit with contra-rotating impellers.

FIGURES issued by the Gas Council show that the rise in sales of gas to industrial undertakings during the nine months to December, 1954, was 9 per cent. over the same period of the previous year. Production of coke was almost unchanged during the nine months, but provisional statistics for the whole financial year indicate that sales are over 4½ per cent. up on the year before.

NEW BRANCH PREMISES of the General Electric Company, Limited—Magnet House, White House Road, Ipswich—were opened by Mr. C. T. Melling, chairman of the Eastern Electricity Board. The new building is twice as large as the premises it replaces. The Ipswich office has enjoyed branch status since 1929. It is under the management of Mr. A. White, who has been with it almost since its foundation.

(*Continued on page* 580)

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FS 14

## *News in Brief*

(*Continued from page 578*)

THE BRITISH MATERIALS HANDLING DIVISION of The Yale & Towne Manufacturing Company, Wednesfield, Wolverhampton, has now issued further details about its range of Wizard electric hoists. In capacities up to 1 ton, all models will now be available with either a three-phase motor or a single-phase (capacitor start) motor. All standard supply voltages and frequencies are catered for.

BECAUSE of the large number of machine tools used by Rolls-Royce, Limited, it has been decided to set up an overhaul factory at Larkhall (Lanarkshire), to maintain these tools on a production basis. The new base will be responsible for the overhaul of machine tools from the Rolls-Royce group of factories in both England and Scotland, and the project will be launched in the autumn of this year.

TYNESIDE firms have conceived a plan whereby ship-repairing workers will have their annual holidays staggered during a six weeks' period beginning in the middle of July. Last year, the holiday period was staggered over three months, but it was found that this length of time caused too much interference with work. One or two firms, however, have made their own individual holiday arrangements.

A BLAST FURNACE at the Stanton Ironworks, which had not been in use since it burst some months ago, was relit on May 16 by five-year-old Teresa Scopes, daughter of Mr. F. V. Scopes, and granddaughter of Sir Frederick Scopes, managing director of the company. The furnace, which has been rebuilt and enlarged, is expected to produce 2,500 tons of iron a week and lead to a 20 per cent. increase in productivity.

AT THE CUTLERS' HALL, Sheffield, recently, Mr. C. E. C. Pontifex, Master of the Armourers' and Brasiers' Company, London, distributed certificates and money prizes for ideas in connection with a competition the company runs among Sheffield firms. Over £100 is distributed in prizes. Twenty employees had gained awards, among them Mr. H. T. Berry who had invented an improvement for a high-temperature thermometer.

AN EXHIBITION on the history, production and application of silicones is to be held in Manchester at the Midland Hotel from June 13 to June 18. The exhibition, entitled "Silicones for Industry," will be open each day from 10 a.m. until 6.30 p.m. with the exception of June 13 when it opens at 2.30 p.m. There are many working exhibits, and film shows will be given at intervals throughout each day. Invitations to the exhibition can be obtained on request from Midland Silicones Limited, 19, Upper Brook Street, London, W.1.

A PRIVATE EXHIBITION designed to introduce industrialists, chemists, engineers and scientists to the wide technical range of Hanovia ultra-violet ray equipment, is being staged at St. Andrew's Halls, Glasgow. It illustrates the use of the equipment for air sanitation, water sterilization, fluorescent analysis, fluorescent crack-detection in metals and plastics, ageing and fading, polymerization, mineral selection and chromatography. The exhibition, "Ultra-violet Rays in Industry and Commerce," which opened on May 16, closes to-morrow.

A CONTRACT for all the electrical sub-station and track-section cabin equipment for the extensions of the Liverpool Street - Shenfield electrification scheme to Chelmsford and Southend has been awarded by the British Transport Commission to the British Thomson-Houston Company, Limited. Under the contract, five 2,000-kW, 1,500-volt pumpless steel tank rectifier equipments are to be installed in four sub-stations, including one two-unit sub-station. There will also be AC switchgear with plug-in type auxiliary transformers and Brentford regulating transformers to give supplies for signalling equipment.

MR. SINCLAIR WEEKS, United States Secretary of Commerce, said at the Castle Bromwich British Industries Fair, that British firms will henceforward have a better chance of bidding for American contracts because of an amendment in the "Buy American" regulation. Until recently the rule allowed an American bidder to be awarded a contract even if his price was as much as 25 per cent. above that of the lowest foreign tender. Now the preference accorded American bidders had been reduced from a difference of 25 per cent. to either 6 or 10 per cent. depending on the way the bid was calculated. Mr. Weeks forecast a good time for British exports to the United States since the Eisenhower administration was committed to the promotion of two-way trade.

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# *Publications Received*

**British Iron and Steel Research Association—Annual Report.** Published by the Association from 11, Park Lane, London, W.1.

This report is well worth study by foundry executives. The general report of the Council gives no clue as to this interest and it is only by turning the pages the founder will learn much which he can apply. For instance, on page 23 one learns that co-operative experiments with the Cross Foundry and Engineering Company Limited have shown that steel can be produced in small quantities by blowing oxygen into hematite iron in a ladle. The process might be useful for iron foundries having occasional demands for steel which do not justify much additional capital expenditure. It is hoped to develop the process further. Again, on pages 24 and 25 experiments are described with varying sizes of electrodes for steel melting furnaces and also with two types of connecting nipples. On the next page, foundry practice for the production of ingot moulds comes in for consideration. The last piece of information that caught the reviewer's eye was a paragraph which stated that spectrographic analysis of steel was not satisfactory for the determination of carbon, sulphur and phosphorus, but a new British apparatus being developed had real possibilities in this direction.

**Scope of Gamma-Radiography, by L. Mullins, Ph.D.** The paper Dr. L. Mullins, M.Sc., F.Inst.P., F.R.P.S., A.I.M., presented during the 1954 industrial electronics convention at Oxford—"Scope of Gamma-Radiography"—has now been reprinted in booklet form by courtesy of the British Institution of Radio Engineers. In it Dr. Mullins discusses the relative merits and uses of X-rays and gamma-rays, with particular reference to their uses in industry. The various kinds of artificial radio-isotopes available for commercial use; the useful life that can be expected from each; safety precautions necessary; and the techniques used in the radiography of castings and welds are all discussed impartially and with authority. He makes the point that the increasing availability of gamma-ray sources arising out of atomic-energy research, has brought the advantages of industrial radiography to many manufacturers who had, perhaps, previously regarded radiographic inspection as uneconomic. However, the comparative cheapness of these new sources has also led to gamma-radiography being used in circumstances where X-ray examination would be more suitable.

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## Personal

The Federation of British Industries has appointed Major H. M. BURTON as its liaison officer for the Middle East.

Dr. OLIVER H. WYATT, who is University demonstrator in engineering, has been elected into an official Fellowship at Christ's College.

Mr. R. S. BUSHNELL, technical sales representative for Beetle foundry resins in the UK is now visiting Sweden and Norway for a period of three weeks.

Sir GEOFFREY MANDER, the Wolverhampton industrialist, has been installed as president of the Birmingham branch of the Incorporated Sales Managers' Association.

Mr. A. F. KISTNER has been appointed general manager of the Manchester switchgear works of Cooke & Ferguson, Limited, a subsidiary of Crompton Parkinson, Limited.

Mrs. C. A. SALVESEN, director and secretary of the Kresta Foundry & Engineering Company, Limited, Hunts Cross, has been appointed the first woman chairman of the Liverpool Chamber of Commerce.

THE NORTH-EAST BRANCH of the Institution of Engineering Designers has made a presentation to Mr. R. A. H. HUDSPETH, founder and former secretary of the branch, in recognition of his work for the institution.

MR. J. C. K. BALFRY, works engineer, of C. & W. Walker, Limited, Donnington, Salop, has retired after 42 years of service with the company. He has been presented with gifts from members of the executive and the office and works staff.

Mr. R. P. ALLDAY, joint managing director of P. G. Allday & Company, Limited, general brassfounders, Birmingham, is the new president of the National Brassfoundry Association, with which the firm has been associated for over 50 years.

Mr. JAMES HOWARD BARWELL, director of Allcock & Company (Metals), Limited; Barr Street Castings, Limited; Reeve and Stechford, Limited, and L. G. Harris & Company, Limited, has been elected president for 1955-56 of the Rotary Club of Birmingham.

Mr. ALLEN L. STOCK has been re-elected treasurer of the London Chamber of Commerce. He is managing director of the Morgan Crucible Company, Limited. chairman of the Ship Carbon Company of Great Britain, Limited, and also a director of Lodge Plugs, Limited.

Mr. GAVIN PATERSON, B.SC.(ENG.), a director of Paterson Hughes Engineering Company, Limited, mechanical handling engineers, left this country on May 17 for a visit to Canada and the United States. His tour will cover foundries and industrial plant of all kinds.

THE Minister of Fuel and Power has reappointed Lord CITRINE to serve as chairman of the Central Electricity Authority for another two years when his present term of office expires on August 14. Sir HENRY SELF has also been reappointed to serve as deputy chairman of the Authority from the same date.

Mr. C. T. BROCK has been appointed to take charge of the engineering department of the Essendine (Rutland) works of Allis Chalmers Great Britain, Limited, agricultural implement manufacturers. Mr. Brock has been production manager at Essendine for the past 12 months, and was previously production manager at the company's works at Totton, Southampton.

Mr. BASIL GRIFFITHS has been appointed works manager of the Incandescent Heat Company, Limited, Smethwick (Staffs). Mr. Griffiths is a member of the National Materials Handling Committee of the Institution of Production Engineers and has been publicity officer of the Kidderminster and District Committee of the British Productivity Council since its formation.

THE FORTY-THIRD annual general meeting of the British Engineers' Association, with the president, Mr. H. S. "DICK" BROOM, M.B.E., in the chair, was held on May 12. As a result of the ballot for election to the Council of the Association, Mr. W. T. TOWLER, J.P. (Towler & Son, Limited), and Mr. G. S. WOOD (Thos. W. Ward, Limited) were elected as new members of the Council.

Mr. D. N. MANTON has joined A.P.V.-Paramount, Limited, Crawley, Sussex, as Midland area representative. Mr. Manton is well known in the Midlands as he was previously senior representative of the Sandwell Engineering Company, Limited, West Bromwich. Mr. E. L. ILLSEY is now A.P.V. representative in the north of England. Mr. Illsey was formerly area manager of Accles & Pollock, Limited.

GEORGE KENT, LIMITED, of Luton, state that their export sales of measuring and control equipment reached the record figure of £1 million in 1954; and this has necessitated some expansion and re-organization of the sales staff. One effect is that Mr. J. M. WHITE, lately chief sales engineer. has been appointed to the London office on return from his present visit to Canada. Mr. J. THAM has been appointed chief sales engineer in succession to Mr. J. M. WHITE.

THE following promotions and appointments are announced in the excavator division of Newton, Chambers & Company, Limited, Thorncliffe, near Sheffield:—Mr. W. HAGUE, formerly shops manager, to be works manager; Mr. A. ELLIOTT (assistant service manager) to be field service manager; Mr. A. G. WILSON (assistant manager—sales office) to be assistant sales manager: Mr. P. PADGET (assistant accountant) to be cost accountant; and Mr. B. WATKINSON (senior foreman, welding shop) to be welding shop manager.

## Obituary

Mr. JAMES LOCKWOOD WHITELEY, who has died at Harrogate, was formerly a director of W. Whiteley & Son, Limited, Prospect Ironworks, Lockwood, Huddersfield.

A director of H. & J. Hill (Willenhall), Limited, ironfounders, until his retirement eight years ago, Mr. HERBERT AUGUSTUS TAYLOR has died at the age of 71. Mr. Taylor had been associated with the firm for nearly 50 years.

The death has occurred of Mr. HAROLD EDWARD WHITE, chairman of the Carron Company, ironfounders, etc., of Falkirk. Mr. White, who was 70, joined the company in 1927 as a voting partner, before which he had been a director of the British Thomson-Houston Company, Limited, in its India office. He was appointed chairman of the Carron Company in 1941.

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POL/10

# Raw Material Markets

## Iron and Steel

Business at the ironfoundries continues to be brisk and there is a regular flow of orders and inquiries for castings. Work on hand and on offer is sufficient to keep production at the majority of foundries at capacity levels. Outputs of castings, however, are still controlled by the amount of raw material which can be secured. Demand for pig-iron is far greater than producers can meet. The engineering and speciality foundries are in difficulties, their pig-iron requirements being much in excess of the available supply.

Production of the low- and medium-phosphorus irons is totally inadequate, and the stringency in the supply of hematite and other pig-irons which the engineering foundries can utilize makes it impossible for them to make good the shortage. There appears to be no prospect of the position easing in the near future, and this no doubt accounts for the greater number of inquiries which importers of pig-iron are receiving. However, parcels of suitable foreign pig-iron are scarce, and prices quoted are much higher than those of home-produced irons.

Few of the light and jobbing foundries are faring any better in the supply of high-phosphorus pig-iron, as some furnaces are slow in completing orders on hand, due to their heavy commitments.

Deliveries of foundry coke are well maintained. There is a heavy demand for scrap from the foundries, chiefly for machinery and cast-iron scrap, and parcels arising are taken up readily.

The re-rollers continue to be handicapped by the shortage of semis, although a slight improvement has been effected recently by imports, which it is understood will be on an increasing scale. All the makers of finished steel are fully booked.

## Non-ferrous Metals

A suggested method of passing on to purchasers of semis the benefits which certain consumers enjoy in buying at a special price from the RST group indicates that buyers of rolled copper rods will receive part of their requirements on the basis of £280 and part on the basis of the LME quotation. This should, of course, be reflected in the cost to the consumer of copper wire. In copper sheets the position is more specific, for it is understood that the general price level for these products has been agreed at £286 for the initial 30 days' period, which means that users of this particular type of semi will be buying considerably below the ruling LME price.

Other products in brass and copper will apparently not be affected, the basis for their selling prices continuing to be the daily LME quotation. The whole matter seems to be a good deal confused, but doubtless things will settle down in due course. In the meanwhile, copper has been showing considerable strength, the cash price advancing last Thursday to £335, with three months at £315. A reaction followed to £324 and £304, respectively, but the close last Friday afternoon was £327 and £307 10s., which registered a net gain of £6 for cash and £4 10s. for three months on the week.

In the other metals business was slow. Trading is quietening in face of the onset of the Whitsun holiday and the General Election. The only feature in tin was a widening of the backwardation to £2 10s., cash losing £1 last week and three months gaining 10s. Consumers continue to buy on a hand-to-mouth basis. Zinc was steady and closed 5s. down for the forward position and unchanged for spot, at £90 and £88 10s., respectively. Lead eased off slightly, May being down 5s. and August 15s.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* May 19, £334 10s. to £335; May 20, £323 to £324; May 23, £328 to £329; May 24, £334 10s. to £335; May 25, £331 to £333.

*Three Months:* May 19, £314 10s. to £315; May 20, £303 10s. to £304; May 23, £308 10s. to £309; May 24, £316 to £316 10s.; May 25, £314 to £314 10s.

TIN, Standard—*Cash:* May 19, £714 to £714 10s.; May 20, £714 to £715; May 23, £714 10s. to £715; May 24, £713 10s. to £714; May 25, £714 10s. to £715.

*Three Months:* May 19, £716 10s. to £717; May 20, £716 10s. to £717 10s.; May 23, £714 to £715; May 24, £716 to £717; May 25, £717 to £717 10s.

LEAD—*Second half May:* May 19, £103 to £103 5s.; May 20, £103 to £103 5s.; May 23, £103 15s. to £104; May 24, £103 15s. to £104; May 25, £103 5s. to £103 10s.

*Second half August:* May 19, £102 10s. to £102 15s.; May 20, £102 10s. to £102 15s.; May 23, £103 to £103 5s.; May 24, £103 to £103 5s.; May 25, £103 to £103 5s.

ZINC—*Second half May:* May 19, £89 15s. to £90; May 20, £89 15s. to £90; May 23, £90 to £90 5s.; May 24, £90 10s. to £90 15s.; May 25, £90 10s. to £90 15s.

*Second half August:* May 19, £88 5s. to £88 10s.; May 20, £88 5s. to £88 10s.; May 23, £88 10s. to £88 15s.; May 24, £88 15s. to £89; May 25, £88 15s. to £89.

## Institute of Directors

The director general of the Institute of Directors, Sir Richard Powell, was the principal guest at the annual dinner in Birmingham on May 20 of the Birmingham branch of the Institute. In his speech Sir Richard said that current industrial unrest was dimming the splendid prospects of a second Elizabethan Age which not long ago seemed so bright. He referred to it as industrial treason which cut at the very roots of the country's economic life, and wondered what would happen if directors went on strike.

The chairman of the branch, Mr. Guy Chantrey, also referred to labour unrest. Some politicians, he said, believed they could run industry more efficiently than the experts. He suggested that as a means of preventing workers from being led astray by trouble-makers, companies should issue more information about their affairs to the public and particularly to their own employees. "Is it not the responsibility of directors and management to keep labour better informed about certain financial aspects affecting the company by which they are employed—to avoid discontent, fanned perhaps by a sense of injustice?" he asked.

It was stated that the Birmingham branch, with 1,500 members, continued to lead the country in the Institute's membership drive. The national membership had now reached 15,000 and new directors were joining at the rate of about 700 a month.

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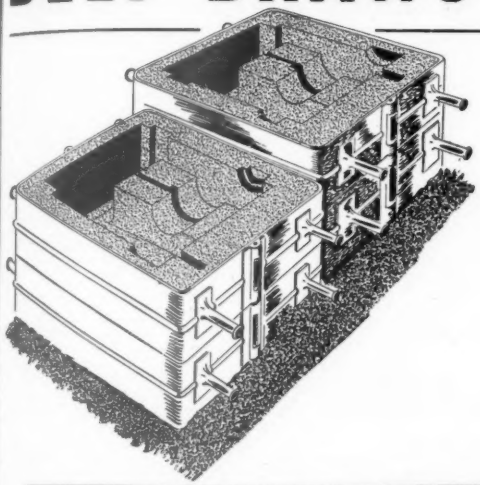
Mr. A. DURBECQ, for many years secretary of the *Syndicat des Fondeurs sur Modeles des Ardennes* and in charge of the regional foundry laboratories in the Ardennes, has announced his retirement. Mr. Durbecq will carry with him the good wishes of foundrymen in this country—and London founders in particular. It was he who arranged works visits for them in that area of France and who later accompanied a party of French foundrymen to this country. He is succeeded at the *Syndicat* by Mr. De Beauregard.

# DEEP DRAWS . . .



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# Current Prices of Iron, Steel, and Non-ferrous Metals

*(Delivered unless otherwise stated)*

May 25, 1955

## PIG-IRON

**Foundry Iron.**—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

**Low-phosphorus Iron.**—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

**Scotch Iron.**—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

**Cylinder and Refined Irons.**—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

**Refined Malleable.**—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

**Hematite.**—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

**Basic Pig-iron.**—£15 15s. 6d. all districts.

## FERRO-ALLOYS

*(Per ton unless otherwise stated, delivered)*

**Ferro-silicon** (6-ton lots).—40/55 per cent., £40 15s. 0d., basis 45 per cent. Si, scale 15s. per unit; 70/84 per cent., £63 0s. 0d., basis 75 per cent. Si, scale 16s. per unit.

**Ferro-vanadium.**—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

**Ferro-molybdenum.**—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

**Ferro-titanium.**—20/25 per cent., carbon-free, £161 0s. 0d. to £165 0s. 0d. per ton; 38/40 per cent., £258 0s. 0d. to £262 0s. 0d. per ton.

**Ferro-tungsten.**—80/85 per cent., 16s. 0d. per lb. of W.

**Tungsten Metal Powder.**—98/99 per cent., 19s. 0d. per lb. of W.

**Ferro-chrome** (6-10 ton lots).—4/6 per cent. C, £83 0s. 0d. to £86 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £81 0s. 0d. to £84 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 10½d. per lb. Cr; 1 per cent. C,* 1s. 11d. per lb. Cr; 0.15 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr; 0.10 per cent. C,* 1s. 11d. to 2s. 2d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

**Metallic Chromium.**—98/99 per cent., 6s. 7¼d. to 7s. 1d. per lb.

**Metallic Manganese.**—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £259 0s. 0d. to £265 0s. 0d. per ton.

**Ferro-columbium.**—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

**Ferro-manganese** (home).—78 per cent., £53 17s. 6d.

## SEMI-FINISHED STEEL

**Re-rolling Billets, Blooms, and Slabs.**—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

* Average 68-70 per cent.

**Billets, Blooms, and Slabs for Forging and Stamping.**—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

## FINISHED STEEL

**Heavy Plates and Sections.**—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

**Small Bars, Sheets, etc.**—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £55 4s. 0d.

**Alloy Steel Bars.**—1 in. dia. and up: Nickel, £54 7s. 9d.; nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

## NON-FERROUS METALS

**Copper.**—Cash, £331 0s. 0d. to £333 0s. 0d.; three months, £314 0s. 0d. to £314 10s. 0d.; settlement, £333 0s. 0d.

**Copper Tubes, etc.**—Solid-drawn tubes, 3s. 1¾d. per lb.; rods, 367s. 9d. per cwt. basis; 20 s.w.g., 401s. 0d. per cwt.

**Tin.**—Cash, £714 10s. 0d. to £715 0s. 0d.; three months, £717 0s. 0d. to £717 10s. 0d.; settlement, £715 0s. 0d.

**Lead (Refined Pig).**—Second half May, £103 5s. 0d. to £103 10s. 0d.; second half August, £103 0s. 0d. to £103 5s. 0d.

**Zinc.**—Second half May, £90 10s. 0d. to £90 15s. 0d.; second half August, £88 15s. 0d. to £89 0s. 0d.

**Zinc Sheets, etc.**—Sheets, 15 g. and thicker, all English destinations, £121 0s. 0d.; rolled zinc (boiler plates), all English destinations, £118 15s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £103 0s. 0d.

**Brass Tubes, etc.**—Solid-drawn tubes, 2s. 7½d. per lb.; rods, drawn, 3s. 4d.; sheets to 10 w.g., 328s. 0d. per cwt.; wire, 3s. 1⅝d.; rolled metal, 313s. 9d. per cwt.

**Brass (Brazing).**—BS1400, B3 (65/35), £207; B6 (85/15), —; BS249, £218.

**Brass (High Tensile).**—BS1400, HTB1 (30 tons), £269; HTB2 (38 tons), £272; HTB3 (48 tons), £281.

**Gunmetal.**—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £287; LG3 (86/7/5/2), £296; G1 (88/10/2/½), £364; (88/10/2/1), £354.

**Phosphor Bronze.**—BS1400, PB1 (AID released), £37[illegible] per ton.

**Phosphor Bronze Strip, etc.**—Strip, 456s. 0d. per cwt.; sheets to 10 w.g., 479s. 6d. per cwt.; wire, 4s. 8½d. per lb.; rods, 4s. 0¾d.; tubes, 3s. 11d.; chill cast bars: solids 4s. 1½d., cored 4s. 2½d. (CHARLES CLIFFORD, LIMITED.)

**Nickel Silver, etc.**—Rolled metal, 3 in. to 9 in. wide x 0.056, 3s. 10¾d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3½d. All prices are net.

**Other Metals.**—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £108 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £163 0s. 0d.; aluminium bronze (BS1400), AB1, £339; AB2, £345. Solder, brazing, BS1845, 2s. 10d. lb.; granulated, 3s. 2d. lb.